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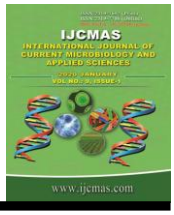

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Analysis of Comparative Genetic Diversity in Two Cultivated Species of Jute

Anita Roy[1], Sourav Hazari[2*] and Sudip Bhattacharya[2]

[1]Department of Genetics and Plant Breeding, AINPJ & AF, Kalyani centre,
[2]Department of Genetics and Plant Breeding, Bidhan Chandra Krishi Viswavidyalaya, W. B., India

**Corresponding author*

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A B S T R A C T

Cultivated species of jute (*Corchorus olitorius* L. and *Corchorus capsularis* L.) are distinct in their growth and characteristics related to dry matter and fibre yield. The present study was planned to evaluate 77 varieties of jute including two checks, each of *C. capsularis* and *C. olitorius*. Characterizations of genotypes of both the species were also carried out on the basis of five marketable traits with their correlation and cluster analysis of them to study the diversity pattern, based on these characters. However they showed considerable variation which indicates that overall genetic variability in the population and there is enough scope of selection. The most interesting parameter being the dry fibre weight and fibre%, was found to be more in *C.olitorius* lines (mean fibre weight was 11.71g and mean fibre% was 6.82%) and OIJ-07 recorded the highest fibre% of 8.28 and also the highest fibre wt of 15.26g. In case of *C.capsularis* the mean fibre % was less (mean 5.83%). When the correlation was studied about the fibre wt with plant height, basal diameter, green wt and fibre %, it represented a strong positive correlation with the green weight as expected and in both the cases it was around 0.8-0.9 depicting that the green weight can be taken as indirect index for selection in the advance materials.

Introduction

Jute is a dicotyledonous fiber-yielding crop, belonging to the genus *Corchorus* of the family Tiliaceae. The genus comprises 50 to 60 species, including the two fiber-yielding cultivated species,*C. olitorius* (tossa jute) and *C. capsularis* (white jute). Cultivated species of jute, (*Corchorus olitorius* L. and *Corchorus capsularis* L.) are distinct in their growth and characteristics related to dry matter and fibre yield. Genetic evaluation and characterization in both the cultivated species of jute have been reported by several workers but they studied the two area separately (Kumar *et al.*, 2005 and Nayak and Baisakh, 2009) and comparative analysis was not done. Success of plant breeding depends upon the nature and

magnitude of variability present in the germplasm. Qualitative characters being more stable over generations and environments are reliable for characterization of germplasm. Since jute has been domesticated only around 200 years ago and many mutants have not yet been accumulated in jute population due to lack of human selection pressure for longer time (Mukherjee and Kumar, 2002), qualitative morphological characters of jute are mostly monomorphic and few are dimorphic and polymorphic. In India, while certain diagnostic features for released or notified jute varieties are known and used in seed certification (Kumar *et al.*, 2005) the descriptors by and large are incomplete. The jute varieties have not so far been extensively described for various heritable morphological traits to enable the selection of lines and advance materials. Hence, the present study was planned to evaluate 77 varieties of jute including two checks, each of *C. capsularis* and *C. olitorius*. Characterizations of genotypes of both the species were carried out on the basis of five important morpho-agronomical traits with their correlation and cluster analysis. However this also depicts that overall genetic variability is low as earlier from the studies of Banerjee *et al.*, 2012 and there is need for creation of variability through interspecific crosses or mutation.

However *Corchorus* species are characterized by a high degree of inter-specific variability, but a low level of intra-specific variability. Due to modern method of cultivation, the genetic base of the cultivated varieties has become very narrow, where *C. olitorius* cultivars are dominating in cultivation as compared to *C. capsularis* varieties. Most of the adapted areas of the jute growing region are represented by only a few olitorius varieties, particularly 'JRO 524'. Narrow genetic base in *C. capsularis* is a matter of great concern in varietal development, Kar *et al.*, 2009.

Materials and Methods

The experimental materials comprising of 75 germplasms & 2 released verities each of two species (*C. olitorius & C.capsularis*) which were collected from AINPJ&AF. The released varieties of tossa jute and white jute are JRO-524 & JRO-204 and JRC-517 & JRC-698 respectively. The experimental materials were grown in a randomized block design with three replications at the Mondouri Teaching Farm of Bidhan Chandra Krishi Viswavidyalaya (West Bengal) during 2015-2016 with plot size 6.0 x 1.60 m^2 with 4 lines in each plot. Row to row and plant to plant distances were 25 cm and 10 cm, respectively. Standard package of practices were followed to raise the crop. Crop was harvested at 120 days after sowing. Data were recorded for five quantitative characters viz. plant height (cm), basal diameter (cm), green weight (gm), fibre weight (gm) and fibre percentage[(Fibre weight / Green weight)×100]. Plant height was recorded as height of the main stem measured from ground level to the point of forking at pre bud stage (before development of first flower). Observations were recorded on 10 randomly selected plants in each of three replications at specified stages of crop growth period when the characters under study had full expression. Genetic analysis was carried out using Excel stat and DARwin software programme.

Results and Discussion

All the genotypes varied significantly for all the traits under observation in both the species. From the mean performance (Table 4 & 5) it was observed that highest plant height (327.33 cm) was observed in case of *C. olitorius* (OIJ 29) followed by OIJ 24 (327.17 cm). By observing overall mean performances (Table 1), plant height of *C. capsularis* genotypes are generally shorter than that of *C. olitorius* as was observed in the mean which

was 255.6 cm for white jute and 294.66 cm in case of tossa jute. Same result observed by Hossain and Sasmal 2006. Highest plant height (317.2 cm) was observed in case of white jute is (CIJ 01) followed by CIN 22 (310.7 cm).

The variety having different plant height, cluster 1 and 3 (Table 3) could be effectively utilized in developing crosses/ selection of genotypes with better plant height because in case of jute it is the most important yield contributing character. Jatothu *et al.,* (2018) conducted an experiment to examine the magnitude of genetic diversity and characters contributing to genetic diversity among 81 tossa jute genotypes. From the other traits studied like basal diameter it was recorded (Table 1) that white jute have more basal diameter (1.51 cm) than tossa jute (1.36cm). This could mean that tall and lanky plants of *C. olitorius* (tossa jute) indicated more chance to lodge following the late showers during August prior to its harvest. Selection for plants with more basal girth would be desirable in case of *C. olitorius*. However in the *C. capsularis* (white jute) highest basal diameter was noted in CIJ 26 (1.73 cm) followed by JRC 698 (1.70 cm) and in olitorius it was OIJ 18 (1.54 cm) followed by OIJ 22 (1.48 cm). In case of green wt per plant the mean was more in case of tossa jute 172.33g but the range was more in white jute (101.87 gm – 246.75 gm), which indicated that there was enough opportunity for selection for this trait. The same trend was seen in case of fibre weight which is quite as expected. The mean fibre weight was 11.71 gm in tossa jute and 8.85 gm in white jute whereas the range was more in *C. capsularis* (13.01gm – 4.89 gm). This also indicates one possibility that though there was considerable variability in both the species but responce to selection would be more in tossa jute and the fibre % was more in some *C.olitorius* lines like OIN -19, OIJ-06 and OIJ-07.

Table.1 Overall mean performances of different traits in two cultivated species

		C. capsularis			***C. olitorius***		
SL NO	**Traits**	**Average**	**Highest**	**Lowest**	**Average**	**Highest**	**Lowest**
1	Plant height (cm)	255.60	317.16	174.70	294.66	327.33	245.33
2	Basal Diameter (cm)	1.51	1.725	1.18	1.36	1.54	1.22
3	Green Weight (gm)	169.44	246.75	101.87	172.33	222.40	113.26
4	Fibre weight (gm)	8.85	13.01	4.89	11.71	15.45	7.79
5	Fibre %	5.03	6.03	3.85	6.82	8.28	5.57

Table.2 Character association studies between fibre yield and other traits

Species	**Traits**	**Plant height**	**Basal diameter**	**Green weight**	**Fibre %**
C. olitorius	Fibre yield	0.768**	0.873**	0.881**	0.546**
C. capsularis		0.328**	0.633**	0.801**	0.330**

Table.3 The group of 154 lines was divided into three clusters on the basis of genetic dissimilarity. The results are given below

SL NO	Lines/ accessions	Group characteristics
1	CIN-01, CIN-07, CIN-08, CIN-12,**CIN-16***, CIN-18, CIN-19 ,CIN-21, CIN-22, CIN-23, CIN-44, CIN-46, CIN-52, CIN-54, CIN-56, CIN-66, CIN-74, CIJ-01, CIJ-05, CIJ-09, CIJ-14, CIJ-23, CIJ-26, CIJ-31, JRC-517, JRC-698,OIN-02, OIN-07, OIN-10, OIN-13, OIN-16, OIN-21, OIN-23, OIN-24 OIN-28, OIN-29, OIN-31, OIN-33, OIN-35, OIN-37, OIN-39, OIN-42, OIN-43, OIN-44, OIN-45, OIN-46 OIN-47, OIN-51, OIN-56, OIN-57, OIN-58, OIN-66, OIN-70, OIN-75, OIN-78, OIN-79, OIN-80, OIN-81, OIN-82, OIN-85,OIJ-02, OIJ-03, OIJ-04, OIJ-07,OIJ-08, OIJ-09, OIJ-10, OIJ-11, OIJ-14, OIJ-15, OIJ-18, OIJ-20, OIJ-22, , OIJ-23, OIJ-24, OIJ-27, OIJ-29, JRO 524, JRO 204 [*CIN 16 is the central object]	Total 79 lines. Plant Height(cm) 293.38, Basal diameter(cm) 1.45, Green weight (gm) 189.46, Fibre weight (gm) 11.86, Fibre % 6.28. Note: 15.97 gm of green wt is responsible for 1 gm dry fibre production.
2	CIN-03, CIN-04, CIN-05, CIN-14, CIN-24, CIN-25, CIN-27, CIN-28, CIN-29, CIN-30, CIN-31, CIN-32, CIN-33, CIN-34, CIN-35, CIN-36, CIN-37, CIN-38, CIN-39, CIN-41, CIN-42, CIN-49, CIN-51, CIN-57, CIN-61, CIN-62, CIN-63, CIN-70, CIN-71, CIN-72, CIN-73, CIN-79, CIN-83, CIJ-02, CIJ-03, CIJ-06, CIJ-08, CIJ-10, CIJ-11, CIJ-12, CIJ-13, CIJ-16, CIJ-19, CIJ-21, CIJ-22, CIJ-25, CIJ-27, **CIJ-29***, CIJ-30, CIJ-32,OIN-04, OIN-11, OIN-53, OIN-64, OIJ-21 [*CIJ-29 16 is the central object]	Total 55 lines. Plant height (cm) 241.72, Basal diameter(cm) 1.40, Green weight (gm) 153.43, Fibre weight (gm) 8.04, Fibre % 5.25. Note: 19.08g of green wt is responsible for 1 g fibre wt
3	CIJ -04,OIN-05, OIN-12, OIN-14, OIN-19 ,OIN-26**, OIN-27***, OIN-34, OIN-36, OIN-54, OIN-55, OIN-61, OIN-67, OIJ-01, OIJ-05, OIJ-06, OIJ-16,OIJ-17, OIJ-19, OIJ-28 [*OIN 27 is the central object]	Total 20 lines. Plant height (cm) 295.01, Basal diameter(cm) 1.32, Green weight (gm) 145.58, Fibre weight (gm) 10.25, Fibre % 7.06. Note: 14.20g of green wt is responsible for 1 g fibre wt

Table.4 Mean performances of different morpho-agronomic traits of *C. capsularis* genotypes

Sl No	Genotypes	Plant height(cm)	Basal diameter (cm)	Green wt (gm)	Fibre wt (gm)	Fibre %
1	CIN-01	295.0	1.49	195.26	10.41	5.27
2	CIN-03	235.7	1.54	169.44	9.92	5.85
3	CIN-04	275.7	1.31	137.04	7.54	5.52
4	CIN-05	198.5	1.20	102.75	5.10	5.01
5	CIN-07	288.3	1.56	222.22	11.87	5.33
6	CIN-08	283.7	1.51	185.58	10.17	5.49
7	CIN-12	295.5	1.47	189.09	9.03	4.82
8	CIN-14	215.8	1.20	128.76	7.35	5.64
9	CIN-16	293.0	1.60	191.05	11.09	5.79
10	CIN-18	286.8	1.49	179.02	10.48	5.86
11	CIN-19	271.8	1.34	161.23	8.66	5.37
12	CIN-21	290.3	1.54	187.48	11	5.87
13	CIN-22	310.7	1.64	202.81	11.64	5.72
14	CIN-23	276.8	1.52	187.67	8.95	4.84
15	CIN-24	185.2	1.22	123.30	4.90	3.95
16	CIN-25	174.7	1.18	101.87	4.93	4.92
17	CIN-27	261.5	1.48	188.33	9.825	5.21
18	CIN-28	241.5	1.39	196.12	8.32	4.25
19	CIN-29	227.2	1.36	155.86	7.29	4.64
20	CIN-30	177.8	1.42	137.96	5.31	3.85
21	CIN-31	233.7	1.40	156.30	7.87	5.14
22	CIN-32	267.0	1.32	129.89	6.72	5.13
23	CIN-33	229.5	1.26	126.47	5.74	4.77
24	CIN-34	252.7	1.44	159.65	7.03	4.41
25	CIN-35	216.2	1.33	145.02	6.33	4.35
26	CIN-36	216.7	1.43	149.71	6.51	4.33
27	CIN-37	221.0	1.45	176.65	7.64	4.41
28	CIN-38	219.3	1.41	153.54	6.94	4.53
29	CIN-39	217.7	1.38	125.57	6.22	4.98
30	CIN-41	233.8	1.43	172.05	7.11	4.11
31	CIN-42	237.7	1.46	178.76	8.3	4.69
32	CIN-44	259.2	1.61	219.45	12.9	5.69
33	CIN-46	268.3	1.72	246.75	11.77	4.76
34	CIN-49	236.0	1.35	171.10	7.69	4.51
35	CIN-51	262.7	1.47	183.06	8.2	4.37
36	CIN-52	271.7	1.49	199.42	10.17	5.10
37	CIN-54	250.3	1.64	244.18	11.61	4.76
38	CIN-56	269.0	1.46	190.53	9.88	5.19

39	CIN-57	236.7	1.63	194.07	10.51	5.44
40	CIN-61	245.8	1.49	179.86	9.10	4.93
41	CIN-62	257.0	1.65	198.67	10.26	5.17
42	CIN-63	246.3	1.44	151.39	9.13	5.91
43	CIN-66	295.2	1.57	197.76	10.75	5.45
44	CIN-70	233.3	1.35	133.81	7.14	5.34
45	CIN-71	259.2	1.42	160.10	8.16	5.18
46	CIN-72	260.5	1.42	146.53	7.82	5.35
47	CIN-73	222.5	1.38	158.73	8.12	4.92
48	CIN-74	261.2	1.60	220.04	10.06	4.56
49	CIN-79	225.0	1.32	137.26	7.19	5.08
50	CIN-83	221.5	1.49	159.68	7.73	4.93
51	CIJ-01	317.2	1.55	193.85	10.82	5.58
52	CIJ-02	267.7	1.45	148.52	8.56	5.76
53	CIJ-03	250.7	1.56	156.98	8.63	5.50
54	CIJ-04	281.0	1.43	149.05	7.87	5.28
55	CIJ-05	286.3	1.58	190.96	10.82	5.69
56	CIJ-06	256.7	1.38	147.77	8.09	5.49
57	CIJ-08	259.5	1.38	151.82	8.57	5.60
58	CIJ-09	274.0	1.49	156.28	9.42	6.03
59	CIJ -10	250.0	1.41	164.83	9.72	5.83
60	CIJ -11	246.5	1.57	153.59	9.32	5.67
61	CIJ -12	260.8	1.41	149.36	7.83	5.15
62	CIJ -13	257.2	1.41	157.78	8.87	5.65
63	CIJ-14	269.0	1.62	171.74	9.89	5.77
64	CIJ-16	260.8	1.40	158.31	8.48	5.36
65	CIJ-19	257.3	1.41	132.87	8.01	5.99
66	CIJ-21	256.3	1.56	183.28	10.44	5.70
67	CIJ-22	256.7	1.57	197.53	10.84	5.52
68	CIJ-23	279.5	1.55	178.09	9.96	5.64
69	CIJ-25	244.0	1.31	109.63	5.89	5.36
70	CIJ-26	309.8	1.73	219.24	11.84	5.40
71	CIJ-27	258.5	1.42	144.63	8.25	5.74
72	CIJ-29	243.8	1.41	153.61	7.56	4.91
73	CIJ-30	259.5	1.59	194.89	10.75	5.52
74	CIJ-31	293.7	1.66	209.50	11.05	5.28
75	CIJ-32	259.7	1.44	155.19	7.8	5.08
76	JRC-517^{+}	304.7	1.56	186.95	10.98	5.86
77	JRC-698^{+}	309.5	1.70	222.32	13.01	5.85
	Mean	255.6	1.51	169.44	8.85	5.03
	Highest	317.16	1.73	246.75	13.01	6.03
	Lowest	174.7	1.18	101.87	4.89	3.85

Table.5 Mean performances of different morpho-agronomic traits of *C. olitorius* genotypes

Sl No	Genotypes	Plant height(cm)	Basal diameter (cm)	Green wt (gm)	Fibre wt (gm)	Fibre %
1	OIN-02	303.50	1.39	171.53	11.58	6.75
2	OIN-04	275.50	1.22	113.26	7.79	6.88
3	OIN-05	296.33	1.43	158.73	11.05	6.96
4	OIN-07	296.50	1.37	196.03	13.54	6.91
5	OIN-10	284.50	1.44	222.40	14.80	6.65
6	OIN-11	245.33	1.23	150.05	10.89	7.26
7	OIN-12	301.17	1.46	145.44	9.55	6.57
8	OIN-13	271.67	1.35	163.09	10.73	6.58
9	OIN-14	288.67	1.28	153.44	11.07	7.21
10	OIN-16	321.50	1.37	172.00	11.75	6.83
11	OIN-19	288.50	1.32	131.89	10.52	7.98
12	OIN-21	286.17	1.41	184.39	12.70	6.89
13	OIN-23	308.34	1.41	201.15	12.22	6.08
14	OIN-24	278.50	1.39	198.81	13.50	6.79
15	OIN-26	296.00	1.20	120.58	8.64	7.17
16	OIN-27	295.50	1.25	148.15	10.33	6.97
17	OIN-28	294.67	1.31	170.77	12.38	7.25
18	OIN-29	292.17	1.35	180.43	11.12	6.16
19	OIN-31	293.67	1.37	196.77	12.37	6.29
20	OIN-33	287.00	1.40	182.84	11.80	6.45
21	OIN-34	285.50	1.24	123.13	8.74	7.10
22	OIN-35	314.17	1.40	177.62	9.70	5.46
23	OIN-36	286.67	1.32	146.71	10.07	6.86
24	OIN-37	275.17	1.46	182.10	10.14	5.57
25	OIN-39	290.34	1.42	204.29	13.73	6.72
26	OIN-42	304.33	1.37	185.01	12.75	6.89
27	OIN-43	304.00	1.41	201.90	13.38	6.63
28	OIN-44	294.50	1.38	187.49	11.40	6.08
29	OIN-45	296.83	1.45	210.50	12.28	5.83
30	OIN-46	294.17	1.47	208.97	13.09	6.26
31	OIN-47	306.83	1.41	167.64	11.31	6.75
32	OIN-51	283.84	1.35	181.40	12.54	6.91
33	OIN-53	266.83	1.23	140.53	8.76	6.23
34	OIN-54	299.34	1.35	155.21	10.35	6.67
35	OIN-55	297.33	1.29	155.01	9.43	6.08
36	OIN-56	315.00	1.31	180.75	13.27	7.34
37	OIN-57	283.50	1.33	172.67	10.71	6.20
38	OIN-58	285.33	1.39	175.21	11.18	6.38

39	OIN-61	297.34	1.31	158.37	11.65	7.36
40	OIN-64	261.67	1.23	120.45	7.95	6.60
41	OIN-66	300.84	1.35	176.80	13.31	7.53
42	OIN-67	289.00	1.29	149.87	9.99	6.67
43	OIN-70	286.83	1.43	189.73	13.67	7.20
44	OIN-75	322.00	1.46	195.80	12.62	6.45
45	OIN-78	274.67	1.31	161.84	11.74	7.25
46	OIN-79	269.50	1.29	187.80	10.78	5.74
47	OIN-80	278.50	1.32	170.10	10.77	6.33
48	OIN-81	295.00	1.36	167.58	10.36	6.18
49	OIN-82	310.83	1.37	187.48	12.45	6.64
50	OIN-85	308.33	1.40	173.66	10.09	5.81
51	OIJ-01	297.50	1.38	154.60	11.28	7.30
52	OIJ-02	296.17	1.44	186.52	13.09	7.02
53	OIJ-03	293.83	1.41	205.45	13.74	6.69
54	OIJ-04	282.50	1.42	193.08	13.97	7.24
55	OIJ-05	290.84	1.39	135.88	10.56	7.77
56	OIJ-06	300.67	1.31	135.82	10.76	7.92
57	OIJ-07	279.00	1.44	184.29	15.26	8.28
58	OIJ-08	316.50	1.37	173.79	13.28	7.64
59	OIJ-09	281.00	1.37	177.90	10.30	5.79
60	OIJ-10	279.84	1.34	163.77	11.65	7.11
61	OIJ-11	311.84	1.44	182.81	12.54	6.86
62	OIJ-14	302.83	1.38	179.69	11.79	6.56
63	OIJ-15	280.33	1.23	157.33	11.03	7.01
64	OIJ-16	304.34	1.24	137.04	9.80	7.15
65	OIJ-17	297.00	1.33	149.89	10.81	7.21
66	OIJ-18	314.50	1.54	212.94	15.45	7.26
67	OIJ-19	301.17	1.27	163.09	12.16	7.46
68	OIJ-20	316.83	1.41	160.05	12.24	7.65
69	OIJ-21	254.00	1.37	164.54	11.34	6.89
70	OIJ-22	308.50	1.48	194.48	12.09	6.22
71	OIJ-23	290.17	1.52	204.35	13.25	6.48
72	OIJ-24	327.17	1.45	194.39	10.92	5.62
73	OIJ-27	317.67	1.39	175.38	12.84	7.32
74	OIJ-28	306.17	1.29	139.65	10.41	7.45
75	OIJ-29	327.33	1.43	200.53	14.64	7.30
76	JRO-524^{+}	314.50	1.44	195.01	14.89	7.64
77	JRO-204^{+}	313.50	1.39	190.19	14.86	7.81
	Mean	294.66	1.36	172.33	11.71	6.82
	Highest	327.33	1.54	222.40	15.45	8.28
	Lowest	245.33	1.22	113.26	7.79	5.57

However the most interesting parameter being the fibre% was more in *C.olitorius* (mean was 6.82%) and OIJ-07 recorded the highest fibre% of 8.28, this line also recorded the highest fibre wt of 15.26g. In case of *C.capsularis* mean fibre % was 5.83. Fibre percentage was lower in white jute [Kumar *et al.,* 2005].

When the correlation was studied (Table 2) about the dry fibre weight with plant height, basal diameter, green wt and fibre%, it showed significant positive correlation with all other traits. This result is same as Ngomuo *et al.,* (2017). But the green weight was found high positive correlation in both the species. The green weight can be taken as indirect index for selection in the advance materials. This was in corroboration to the earlier findings that the *capsularis* genotypess subjected to acute moisture stress at early stage under field condition at Jhargram, West Bengal, gave 54–89% more plant height and accumulated 67% more biomass compared to *olitorius* ones, but the growth difference narrowed down at the later stage as oltorius picked up growth with time, Mahaptra *et al.,* 2009.

It was reported earlier that plant height and basal diameter, have high correlation with fibre yield and they were also identified as criteria for selection [Mahaptra *et al.,* 2009]. But in this case it was found that in both *C.olitorius* and *C. capsularis* green weight showed a positive and high correlation to the fibre weight and this should be used as the selection criteria while handling the advance generation.

Since the seed and fibre purpose crops are grown during different environmental conditions, the seed crop can be further evaluated for these findings which will even help to identify the better lines with their actual evaluation for the fibre yield.

Among the three clusters maximum number of genotypes were contained in cluster 1 with 79 lines followed by cluster 2 (55 lines) and cluster 3 (20 lines). Overall mean plant height was maximum in cluster 3 and minimum in cluster 2. Maximum and minimum overall green weight was found in cluster 1 (189.46 gm) and cluster 3 (145.58 gm). Cluster 1 showed highest (11.86 gm) dry fibre weight whereas cluster 2 showed lowest (8.04 gm) overall dry fibre weight. Fibre recovery from green weight was highest in cluster 3. So, genotypes can be selected from theses three clusters for further crossing programme.

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