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Assessment of genetic diversity in Jute (*Corchorus olitorius* L.) under rain fed condition

SonikaYumnam*, AshutoshSawarkar, S. Mukherjee and K. K.Sarkar

Department of Genetics and Plant Breeding, Bidhan Chandra KrishiViswavidyalaya,
Mohanpur - 741 252, Nadia, West Bengal, India
E-mail- sonikabckv@gmail.com

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Abstract
Jute fibre is obtained from the bark of the two commercially important species namely *Corchoruscapsularis* L. and *Corchorus olitorius* L. 20 genotypes of white jute were sown in Randomized Block Design with three replications classified by Mahalanobis D^2 statistics under rainfed condition to identify desirable genotypes for use in breeding programme to develop drought tolerant hybrids. Maximum inter cluster distance was observed between cluster III and II while cluster III showed the maximum intra cluster distance. Green weight was found to be the maximum contributor (21.58%) towards divergence followed by dry stick weight (20%), top diameter (15.79%) and fibre yield (14.74%). Cluster V was found to be most important group for a number of characters like green weight, bark thickness, basal diameter as well as mid diameter, plant height and internodes length. Therefore, for improvement of the crop the genotypes from clusters V,IV and II may be considered to obtain high fibre yielding lines with characteristic features like earliness and plant with least number of nodes under rain fed condition.

Key words: Tossa jute, fibre, rainfed, divergence, *olitorius,*

Introduction

Jute is a plant based natural fibre and the fibre comes from two important species as *Corchoruscapsularius* and *Corchorusolitorius*belonging to the family Malvaceae (formerly, it was placed in Tiliaceae)and fibre of *olitorius* is shiny and golden in colour and adorably christened as 'Golden Fibre'.The former species is known as White Jute and the later as Tossa Jute. Kundu (1951) is of the opinion that the primary centre of origin of *C. olitorius*is Africa and secondary centre of origin may be India or the Indo-Burma region and origin of *C. capsularis*as Indo-Burma region. 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. However, some constraints in jute cultivation and research have been identified. The cultivation requires lot of water for irrigation which is often found limited due to late showering and low moisture retention capacity in soil and air (Susmita*et al*., 2012). Evaporation loss and mean maximum temperature decline considerably during the monsoon month while relative humidity increases. Thus, in the early part of life, jute plant often is exposed to water stress in the form of atmospheric and soil drought which may affect the jute crop severely in extremely dry year. In West Bengal jute is sown within 1st fortnight of April. This period is often accompanied by unpredictable and very low rainfall. Therefore, timely sowing and uniform seedling establishment of jute mostly depend on availability of assured irrigation which the farmers cannot always afford. From this context, the present investigation was conducted to classify*olitorius*genotypes under rainfed condition to identify desirable genotypes for use in breeding programme to develop drought tolerant hybrids.

Materials and Method

A set of 20 genotypes ofwhite jute (*Corchorusolitorius L.*) including 3 exotic, 2 national released varieties, 9 indigenous and 6 accessions of International Jute Organization (IJO) were sown Randomized Block Design with three replications having a plot size 3 m ×1.5 m for each genotype with interplot distance of 0.5 m. at teaching farm Mondouri, Bidhan Chandra KrishiViswavidyalaya, Nadia, West Bengal. The sowing of the genotypes was done on 10th April, 2010 and 13th April, 2011. Recommended doses of major nutrient (40 Kg N, 20kg $P_2O_5$and 20 kg K_2O) and FYM at 3 tons/ha were applied the crop. Except days to 50% flowering which was studied on plot basis,

observations on other quantitative characters like plant height (cm), number of nodes, internode length(cm), base diameter (cm), mid diameter (cm) top diameter (cm), bark thickness (mm), green weight (g),dry stick weight (g) and fiber weight (g) were recorded on five randomly selected plants per replication per genotype. Genetic divergence among 20 genotypes was estimated by using MahalanobisD^2statistics following (Rao, 1952) with data of error variance-covariance and mean values of 11 traits. Genotypes were grouped into 5 cluster following Toucher's method as described by (Rao, 1952) using IndoStat software.

Results and Discussion

Genetic divergence was studied for twenty genotypes of *C. olitorius* for fibre yield and its attributing traits over two years (2010 and 2011). Analysis of variance indicated the existence of significant variation in the material studied for all the characters.On the basis of diversity among the genotypes, five distinct clusters were identified accommodating the genotypes where cluster I comprised of eleven genotypes (OIN 975, OIN 915, OIN 955, OIN 981, OIJ257, OIN 994, OIJ 216, OEX 024, OIN 941, OIN 921 and OIN 937) was found to have the maximum number of genotypes followed by cluster II and cluster III with four (OIJ 246, OIN 986, JRO 8432 and JRO 524) and three (OEX 019, OIJ 213, and OIJ 299) genotypes respectively (Table 1). Cluster IV and V were identified as monogenotypic.The genotypes belonging to the same cluster indicated that they were more closely related than those present in separate clusters. In respect of the characters studied, grouping of the genotypes into a more number of clusters indicated presence of greater divergence among these genotypes. Earlier Sandip*et al.* (2005) grouped fifteentossa jute cultivar into four clusters, Nayak*et al.* (2009) grouped 35 genotypes into eight clusters and Roy *et al.* (2011) grouped fifty two genotypes into twenty clusters.

The intra-cluster distance was found to be ranged from 0.00 to 4.57 and inter-cluster distance was 5.25 to 8.78. However, maximum inter cluster distance was observed between cluster III and II followed by V and III and cluster V and IV. Cluster III showed the maximum intra cluster distance followed by cluster I and II (Table 2). Wide genetic diversity was evident among the genotypes of different group than those of the same cluster. The higher inter cluster distance between cluster III with cluster II followed by cluster V indicated that the genotypes belonging to cluster III was widely distanced genetically from those of cluster II and V. Minimum inter cluster distance was observed between cluster I and II and cluster I and IV followed by cluster I and V which indicated that genotypes of clusters I and II, clusters I and IV and clusters I and V were genetically closer within respective groups.It could be predicted that the genotypes belonging to different clusters separated by high estimated statistical distance could be used in hybridization programme to develop drought tolerant line in jute which could be successfully overcome drought at early phase of growth.

Based on cluster means for different characters (Table 3) cluster V was found to be most important group for a number of characters like green weight, bark thickness, basal diameter as well as mid diameter, plant height, internode length, cluster IV for fibre yield, basal diameter and cluster II for earliness, internode length with least number of node. So, for improvement of the crop the genotypes from these clusters may be considered to obtain high fibre yielding lines with characteristic features like earliness and plant with least number of nodes under rainfed condition.

Green weight was found to be the maximum contributor (21.58%) towards divergence followed by dry stick weight (20%), top diameter (15.79%) and fibre yield (14.74%) (Table 4).Nargis*et al.* (2010) also observed green weight and stick weight contributed considerably to the total divergence. Maximum contribution towards genetic divergence by stick weight followed by plant height, fibre yield and bark thickness was also observed by Nayak*et al.* (2009) and Sandip*et al.* (2005) reported high contribution of individual plant weight and fibre yield towards diversity.

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Table 1: Grouping of twenty genotypes of *C. olitorius* on different clusters under rainfed condition.

SL.No.	Cluster No.	Total No. of genotypes	Name of genotypes
1	I	11	OIN 975, OIN 915, OIN 955, OIN 981, OIJ257, OIN 994, OIJ 216, OEX 024, OIN 941, OIN 921,OIN 937
2	II	4	OIJ 246, OIN 986, JRO 8432, JRO 524
3	III	3	OEX 019, OIJ 213, OIJ 299
4	IV	1	OIJ 284
5	V	1	OEX 008

Table 2: Intra and Inter cluster distance of *C. olitorius* under rainfed condition.

Cluster	Cluster I	Cluster II	Cluster III	Cluster IV	Cluster V
Cluster I	3.86	5.25	6.47	5.25	5.54
Cluster II		3.07	8.78	6.98	5.79
Cluster III			4.57	6.78	7.94
Cluster IV				0.00	7.31
Cluster V					0.00

Table 3: Cluster mean of *C. olitorius* under rainfed condition.

Cluster	Days to 50% flowering	Plant height (cm)	Node No.	Internode length (cm)	Base diameter (cm)	Mid diameter (cm)	Top diameter (cm)	Bark thickness (mm)	Green weight (g)	Dry stick weight (g)	Fibre weight (g)
Cluster I	104.00	269.77	52.98	4.48	1.32	0.88	0.58	1.40	172.95	18.26	8.71
Cluster II	101.75	262.50	50.38	4.97	1.40	0.98	0.63	1.31	206.25	19.95	8.33
Cluster III	107.22	243.33	55.00	4.25	1.36	0.84	0.95	1.38	176.67	17.61	8.11
Cluster IV	112.00	334.17	63.50	3.69	1.73	1.10	0.72	0.95	280.00	22.67	14.83
Cluster V	104.00	335.83	65.83	4.85	1.95	1.27	0.72	1.71	365.00	30.79	8.83

Table 4: Contribution of individual characters towards total genotypic divergence in 20 genotypes of *C. olitorius*under rainfed condition.

Sl. No.	Characters	Number of times appearing as first in rank	Percent contribution towards divergence D^2 statistics
1	Days to 50% flowering	8	4.21 %
2	Plant height	4	2.11 %
3	Node No.	1	0.53 %
4	Internode length(cm)	10	5.26 %
5	Base diameter	7	3.68 %
6	Mid diameter	5	2.63 %
7	Top diameter	30	15.79 %
8	Bark thickness	17	8.95 %
9	Green weight	41	21.58 %
10	Dry stick weight	39	20.53 %
11	Fibre weight	28	14.74 %