Assessment of genetic divergence of deshi jute (*Corchorus capsularis*) germplasms by using phenotypic characters

A Miah¹*, NR Saha², MY Ali³, M Kamrujjaman⁴, MSMS Parvej⁵

¹Genetic Resources and Seed Division, Bangladesh Jute Research Institute, Manik Mia Avenue, Dhaka 1207, Bangladesh; ²Department of Biotechnology, Bangladesh Agricultural University, Mymensingh 2202, Bangladesh; ³Fibre Quality Improvement Division, Bangladesh Jute Research Institute, Manik Mia Avenue, Dhaka 1207, Bangladesh; ⁴Agronomy Division, Bangladesh Jute Research Institute, Manik Mia Avenue, Dhaka 1207, Bangladesh; ⁵Jute Research Sub-station, Bangladesh Jute Research Institute, Tarabo, Narayanganj, Bangladesh.

Abstract

Twenty-two morpho-agronomic traits of 42 jute genotypes, including 4 varieties with 38 accessions of *C. capsularis* were evaluated to assess the extent and patterns of variability and their relationships. Seed traits exhibited a wider range of variation than fiber traits. Qualitative traits were also the most informative. Considerable ranges of variability were observed in stem colour, petiole colour, stipule colour, plant technical height, base diameter, dry fibre weight and dry stick weight. Based on major yield contributing characters’ accessions 628, 633, 635 and 646 performed better in most of the cases than the control variety CVL-1, CVE-3, BJC-7370 and BJC-83.

Key words: Qualitative trait, fibre yield, plant base diameter, petiole length, pod length, seed yield

Introduction

Jute (*Corchorus* spp.) is a natural fibre crop and is second in the world after cotton in terms of global production, consumption and availability. It is a completely biodegradable, recyclable and eco-friendly lingo-cellulose fibre (Kundu, 1951; Mir *et al.*, 2008). The jute fibres are derived from the bark of the plant. The genus *Corchorus* belongs to the family Malvaceae, which is composed of approximately 100 species (Saunders, 2001). Of these, two species (*Corchorus capsularis* L. and *Corchorus olitorius* L.) are widely cultivated for natural fibre in areas distributed throughout the tropical and sub-tropical regions of the world, particularly in Asia, Africa and Latin America (Kundu, 1951; Edmonds, 1990; Hossain *et al.*, 2002). The most common use of jute fibre is in packaging materials such as hessian, sacking and ropes. A variety of products, such as floor coverings, home textiles, agro-textiles, blankets, handicrafts and fashion accessories, are also made from jute. In recent years, jute has been used for making pulp and papers in the paper industry (Mohiuddin *et al.*, 2005).

The fiber yield of jute in Bangladesh, the second largest producer in the world, has slightly increased from 1.74 t ha⁻¹ in 1999-2000 to 2.22 t ha⁻¹ in 2009-2010 (BBS, 2010), despite the expanding global demand for natural fibre. In addition, seed is a basic input for any crop production program, which leads inevitably for agricultural change of a country but Bangladesh has been facing an acute shortage of quality jute seed every year (Hossen *et al.*, 2008), due to the lack of work on breeding new superior varieties.
Phenotypic characters divergence of deshi jute

Based on fibre and seed yield as well as for insect and disease attached. For controlling the common jute hairy caterpillar, egg parasitoids are most efficient to control as bio-agent (Islam et al., 2002). Now-a-days, various pest management programs are also available for safe environmental crop production (Islam, 2012; Islam and Ando, 2012). Furthermore, the two cultivated species of jute are different in terms of growth habitat, disease and pest resistance and characteristics related to fibre and seed yield (Kundu, 1951; Edmonds, 1990). For example, C. olitorius is relatively tolerant to diseases and pests and produces a stronger fibre than C. capsularis, whereas C. capsularis is more resistant to water logging and drought (Roy et al., 2006). Combining the desirable traits of the two species would be advantageous; however, these species cannot be crossbred, possibly because of the presence of a strong sexual incompatibility barrier between them (Patel and Datta, 1960). Nevertheless, Islam and Rashid (1960) and Choudhuri and Mia (1962) have succeeded in producing hybrids. Moreover, advanced technologies such as somatic hybridization, chromosome doubling, embryo rescue and genetic transformation could be used to overcome the sexual incompatibility problems (Saha et al., 2001; Ghosh et al., 2002). If jute is to be genetically improved, the divergent genotypes must first be identified, the genetic variability characterized and the degree and nature of the associations of various traits with yield determined. The gene bank of the Bangladesh Jute Research Institute has 5,936 accessions of jute and allied fibre crops (Haque et al., 2007) that could be used to accomplish this goal. Although some diversity studies were carried out with molecular markers to evaluate the genetic variation in jute (Basu et al., 2004; Roy et al., 2006). Thirty-eight accessions of deshi jute (Corchorus capsularis) germplasm received from different sources were characterized for morpho-agronomic traits to evaluate the promising types.

Materials and Methods

The experiment was conducted by sowing seeds on 7 April, 2016. Thirty-eight entries along with the check varieties CVE-3, CVL-1, BJC-7370 and BJC-83 were taken to this study. Each accession was sown in 5 rows of 3 m length; spacing was 30 cm between rows, 5-6 cm between plants and 1 m between plots. Standard cultural and inter-cultural practices were followed. Pigmentation data on stem colour, leaf colour, vein colour, petiole colour, stipule colour, bud colour, and fruit colour were collected at 60 days after sowing and pre-bud stage. Plants were harvested at 120 days after sowing and post-harvest data were collected as per Corchorus Descriptor. Data were analyzed following standard statistical procedures.

Results and Discussion

The analysis of variance (ANOVA) for fibre yield components in deshi jute germplasm is described in Table 1.

Table 1. Analysis of variance (mean square) for traits of C. capsularis.

| Source of variation | df | Tech ht (m) | Leaf Angl (dg) | Leaf Lnth (cm) | Leaf Width (cm) | Petiol Lnth (cm) | Node No. | Base Dia (mm) | Middle Dia (mm) | Top Dia (mm) | Core Dia (mm) | Dry Fibre wt. (g) | Dry Stick wt. (g) |
|---------------------|----|-------------|----------------|----------------|----------------|-----------------|----------|---------------|-----------------|--------------|---------------|----------------|------------------|
| Replication         | 2  | 0.020       | 6.768          | 0.099          | 0.065          | 0.003           | 12.167   | 0.177         | 0.042           | 0.044        | 0.006         | 0.086         | 1.179           |
| Accessions          | 42 | 0.414**     | 28.634**       | 6.065**        | 1.850**        | 4.095**         | 240.936** | 56.407**      | 9.281**         | 1.928**      | 24.003**      | 22.029**      | 192.546**       |
| Error               | 82 | 0.021       | 9.670          | 0.129          | 0.048          | 0.053           | 8.386    | 0.188         | 0.151           | 0.067        | 0.265         | 0.222         | 2.385           |

** = Significant at 1% level of probability.
The ANOVA revealed significant difference as the source of variation, for the traits plant height (m), base diameter (cm), fibre weight (g/plant) and stick weight (g/plant). All parameters are significantly different at 1% level of significance. The findings of the analysis of variance (ANOVA) for fibre yield components in deshi jute germplasm are similar to the findings of Roy et al. (2018).

The mean performance of the major yield contributing characters and co-efficient of variation are presented in Table 2.

Table 2. Range, Mean and co-efficient of variation (CV %) of twelve characters of forty Corchorus capsularis germplasm.

| Acc. No. | Tech ht (m) | Leaf Lnth (cm) | Leaf Width (cm) | Petiol Lnth (cm) | Base Dia (mm) | Middle Dia (mm) | Top Dia (mm) | Core Dia (mm) | Dry Fibre wt. (g) | Dry Stick wt. (g) |
|----------|-------------|----------------|-----------------|------------------|----------------|----------------|--------------|---------------|-----------------|-----------------|
| 601      | 2.16        | 51             | 12.65           | 5.22             | 3.12           | 51             | 15.21        | 7.48          | 4.12           | 11.41          |
| BJC-7370 | 2.98        | 45             | 14.72           | 5.66             | 4.81           | 62             | 19.15        | 10.23        | 4.65           | 17.32          |
| 602      | 3.12        | 52             | 15.17           | 6.23             | 5.12           | 65             | 17.29        | 12.44        | 5.25           | 18.58          |
| 605      | 2.65        | 53             | 13.66           | 5.89             | 5.25           | 54             | 13.75        | 8.56          | 4.26           | 12.56          |
| BJC-83   | 3.11        | 46             | 14.58           | 6.22             | 6.11           | 69             | 23.25        | 12.33        | 5.36           | 18.25          |
| 606      | 2.69        | 45             | 13.24           | 5.78             | 5.54           | 52             | 12.69        | 8.58          | 4.15           | 12.47          |
| CVL-1    | 3.19        | 48             | 14.65           | 5.93             | 6.22           | 68             | 23.58        | 12.45        | 5.28           | 18.36          |
| 609      | 2.93        | 47             | 12.41           | 5.82             | 5.88           | 55             | 21.36        | 8.85          | 4.79           | 16.24          |
| 611      | 2.86        | 50             | 11.88           | 5.11             | 5.15           | 54             | 20.58        | 9.58          | 4.96           | 16.87          |
| CVE-3    | 2.82        | 52             | 13.63           | 6.03             | 5.29           | 51             | 18.47        | 10.23        | 4.57           | 18.15          |
| 612      | 2.99        | 51             | 14.11           | 6.78             | 6.08           | 56             | 22.56        | 12.14        | 5.04           | 17.26          |
| 613      | 3.17        | 53             | 14.97           | 6.74             | 6.78           | 72             | 24.12        | 12.49        | 5.12           | 18.59          |
| 620      | 3.22        | 46             | 14.22           | 6.77             | 6.85           | 73             | 24.51        | 12.58        | 5.23           | 18.62          |
| 621      | 2.65        | 50             | 12.48           | 5.12             | 5.36           | 52             | 16.22        | 8.51          | 4.11           | 12.41          |
| 624      | 3.25        | 55             | 15.49           | 7.22             | 6.92           | 71             | 24.67        | 12.78        | 5.54           | 18.56          |
| 625      | 2.48        | 54             | 12.28           | 5.52             | 4.21           | 49             | 12.14        | 8.26          | 3.95           | 10.25          |
| 626      | 3.12        | 46             | 14.52           | 6.59             | 6.65           | 69             | 23.98        | 12.15        | 5.25           | 17.98          |
| 627      | 3.36        | 50             | 15.77           | 7.14             | 6.92           | 72             | 24.77        | 12.27        | 5.28           | 18.57          |
| 628      | 3.79        | 51             | 16.89           | 7.97             | 7.85           | 78             | 25.13        | 13.23        | 6.77           | 20.54          |
| 630      | 2.88        | 49             | 13.23           | 6.96             | 5.99           | 61             | 19.36        | 10.29        | 4.87           | 13.27          |
| 631      | 2.96        | 53             | 14.11           | 6.85             | 6.07           | 59             | 20.58        | 10.58        | 4.12           | 16.59          |
| 632      | 3.19        | 53             | 14.97           | 6.81             | 6.84           | 68             | 24.45        | 12.48        | 5.29           | 18.48          |
| 633      | 3.56        | 47             | 16.65           | 7.78             | 7.61           | 76             | 24.98        | 13.06        | 6.35           | 20.09          |
| 634      | 2.77        | 52             | 11.66           | 4.98             | 4.62           | 55             | 21.56        | 9.88         | 4.58           | 12.95          |
| 635      | 3.44        | 46             | 15.89           | 7.47             | 7.24           | 74             | 24.75        | 12.86        | 6.08           | 19.83          |
| 636      | 2.83        | 48             | 13.76           | 6.25             | 5.27           | 51             | 21.59        | 10.25        | 4.89           | 14.65          |
| 637      | 2.98        | 55             | 13.62           | 5.97             | 3.79           | 61             | 23.55        | 11.65        | 5.21           | 15.28          |
| 638      | 2.95        | 54             | 14.14           | 5.68             | 5.25           | 60             | 16.25        | 10.47        | 5.22           | 16.82          |
| 639      | 2.69        | 52             | 13.92           | 5.87             | 5.27           | 58             | 14.15        | 9.58         | 4.25           | 15.73          |
| 640      | 3.58        | 46             | 16.55           | 7.25             | 7.49           | 75             | 25.04        | 13.11        | 6.52           | 20.25          |
| 641      | 1.76        | 48             | 10.67           | 4.55             | 2.96           | 46             | 11.24        | 6.45         | 3.14           | 9.76           |
| 642      | 3.29        | 49             | 15.93           | 7.14             | 7.27           | 71             | 23.56        | 12.86        | 6.23           | 18.74          |
| 645      | 2.87        | 52             | 13.87           | 6.59             | 5.83           | 58             | 16.54        | 11.25        | 4.54           | 16.51          |
| 646      | 3.39        | 54             | 15.98           | 7.33             | 7.18           | 72             | 24.29        | 12.45        | 6.55           | 19.89          |
Phenotypic characters divergence of deshi jute

| Accession | Height (m) | Base Diameter (cm) | Dry Stick Weight (g) | Dry Fibre Weight (g) | Percentage (%) of Genetic Advance (GA) |
|-----------|------------|--------------------|----------------------|---------------------|---------------------------------------|
| 649       | 3.32       | 48                 | 15.46                | 7.09                | 23.96, 12.14, 6.11, 19.24, 18.12, 52.41 |
| 659       | 3.18       | 53                 | 15.23                | 7.12                | 23.55, 12.23, 5.98, 18.92, 17.96, 49.52 |
| 660       | 2.59       | 55                 | 12.87                | 5.88                | 12.44, 8.56, 4.56, 15.53, 14.25, 39.63 |
| 674       | 2.93       | 54                 | 13.21                | 6.21                | 21.87, 11.25, 4.77, 17.54, 16.35, 46.59 |
| 676       | 2.77       | 49                 | 13.45                | 5.52                | 20.45, 10.21, 4.58, 14.86, 15.39, 43.21 |
| 678       | 3.02       | 47                 | 14.87                | 6.78                | 23.56, 12.23, 4.25, 18.52, 17.79, 48.98 |
| 679       | 2.71       | 50                 | 12.99                | 6.22                | 14.25, 10.51, 4.73, 14.15, 15.29, 42.65 |
| 680       | 3.09       | 53                 | 15.05                | 7.02                | 22.59, 11.99, 4.42, 18.58, 16.46, 46.45 |

Range: 1.76-3.79, 45-55, 10.67-16.86, 4.55-7.97, 2.96-7.85, 46-78, 11.24-25.13, 6.45-13.23, 3.14-6.77, 9.76-20.54, 7.85-19.98, 17.59-56.48
Mean: 2.98, 50.28, 14.17, 6.39, 5.90, 62.07, 20.42, 10.98, 5.01, 16.64, 16.53, 47.67
CV(%): 11.58, 6.79, 6.28, 13.56, 17.58, 14.29, 15.67, 12.48, 15.85, 16.72, 21.39, 22.65

*= Check Variety

Pigmentation data on stem colour, leaf colour, vein colour, petiole colour, stipule colour, bud colour, and fruit colour are presented in Table 3. The plant technical height at harvest (120 days) ranged from 1.76-3.79. The highest score was observed in accession no. 628 (3.79 m/plant), followed by accessions 633 (3.56 m/plant), accessions 635 (3.44 m/plant), accessions 646 (3.39 m/plant). Dry fibre weight ranged from 7.85-19.98 g/plant. The highest dry fibre weight was observed in accession no. 628 (19.98 g/plant) and followed by accession 633 (19.32 g/plant), accession 635 (18.92 g/plant) and accession 646 (18.85 g/plant). Dry stick weight ranged from 17.59-56.48 g/plant. The highest score was recorded in accession 628 (56.48 g/plant) followed by acc. no. 633 (55.89 g/plant), acc. no.635 (53.69 g/plant), and 646 (53.67 g/plant). Similar result was found in Annual Research Report (2016) BJRI in different accession. Among the accession characterized, four viz. accession 628, 633, 635 and 646 performed better in respect of major yield contributing characters than the controls CVE-3, CVL-1, BJC-7370 and BJC-83.

The phenotypic coefficient of variation (PCV) was found to be greater than the genotypic coefficient of variation (GCV) in case of all the characters (Table 4). The percentage (%) of PCV of plant height 13.07, base diameter 21.30, dry fibre weight 16.55 and dry stick weight 17.50 and the percentage (%) of GCV of plant height 12.13, base diameter 21.19, dry fibre weight 16.31 and dry stick weight 17.18 were found in this study. The GCV and PCV were found to differ significantly for all the fibre yield components. This is in agreement with the findings of Sawarkar et al. (2014). The percentage (%) of heritability of plant height 86.18, base diameter 99.01, dry fibre weight 97.04 and dry stick weight 96.37 and the percentage (%) of genetic advance (GA) of plant height 23.17, base diameter 15.51, dry fibre weight 13.42 and dry stick weight 12.46 were found in this study. The heritability and genetic advance (%) of mean were also found to be high for all the traits and this is similar to the findings of Roy et al. (2015) who reported that higher heritability and genetic advance for fibre yield components of deshi jute.

All genotypes were distributed in distinct divergent clusters. The distribution of the deshi jute germplasm accessions exhibiting higher fibre yield along with the different morpho agronomic factors in the five groups of divergent clusters are presented in (Table 5 and Figure 1). In the first group of divergent clusters consisting of cluster-I, six genotypes having higher average rank namely serial no. of Ac 01, Ac 04, Ac 16, Ac 29, Ac 31 and Ac 37 belonged to cluster-I. In the second group of divergent clusters consisting of cluster-II, ten genotypes namely serial no. of Ac 02, Ac 06, Ac 08, Ac 09, Ac 14, Ac 20, Ac 24, Ac 26, Ac 39 and Ac 41 belonged to cluster-II. In the third group of divergent clusters consisting of cluster-III, nine genotypes namely serial no. of Ac 03, Ac 10, Ac 11, Ac 21, Ac 27, Ac 28, Ac 33, Ac 38 and Ac 42
### Table 3. Pigmentation of *Corchorus capsularis* germplasm along with check variety CVE-3, CVL-1, BJC-7370 and BJC-83.

| Acc. No. | Stem color | Leaf color | Vein color | Petiole color | Stipple color | Stipple color | Bud color | Fruit Color | Branch habit | Leaf shape |
|----------|------------|------------|------------|---------------|---------------|---------------|-----------|-------------|-------------|------------|
| 601      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Rudimentary | Ovate      |
| BJC-7370 | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate      |
| 602      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate      |
| BJC-83   | G/R        | G          | G          | G             | +             | G             | 0         | Brown       | Rudimentary | Ovate-lanceolate |
| 606      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Sparse      | Ovate-lanceolate |
| CVL-1    | G          | G          | G          | G             | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 609      | G          | G/R        | G          | G/R           | +             | G/R           | 0         | Brown       | Rudimentary | Ovate-lanceolate |
| 611      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| CVE-3    | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 612      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 613      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Rudimentary | Ovate-lanceolate |
| 620      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 621      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Rudimentary | Ovate-lanceolate |
| 624      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 625      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Rudimentary | Ovate-lanceolate |
| 626      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 627      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 628      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 630      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 631      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 632      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate      |
| 633      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 634      | G/R        | G          | G          | G/R           | +             | G/R           | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 635      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 636      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 637      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate      |
| 638      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate      |
| 639      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 640      | R          | G          | G          | G/R           | +             | G/R           | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 641      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 642      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 645      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 646      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 649      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 659      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 660      | G          | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 674      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Rudimentary | Ovate      |
| 676      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 678      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 679      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |
| 680      | G/R        | G          | G          | G/R           | +             | G             | 0         | Brown       | Non branch  | Ovate-lanceolate |

G = Green, R = Red, LR = Light Red, "+" = Present, * Check variety.
Phenotypic characters divergence of deshi jute

Table 4. Variability, heritability (h²b), genetic advance (GA) and GA in percent of mean for twelve yield and its related characters of *C. capsularis*.

| SL. No. | Characters       | Minimum | Maximum | Mean | Genotypic variance (d²g) | Phenotypic variance (d²p) | GCV (%) | PCV (%) | Heritability (h²b) | GA   | GA(%) |
|---------|-----------------|---------|---------|------|--------------------------|--------------------------|---------|---------|-------------------|------|-------|
| 1       | Tech ht (m)     | 1.76    | 3.79    | 2.98 | 0.13                     | 0.15                     | 12.13   | 13.07   | 86.18             | 0.69 | 23.20 |
| 2       | Leaf Angl (dg)  | 45.00   | 55.00   | 50.29 | 6.321                    | 15.99                    | 5.00    | 7.95    | 39.53             | 3.26 | 6.48  |
| 3       | Leaf Lnth (cm)  | 10.67   | 16.86   | 14.18 | 1.979                    | 2.108                    | 9.92    | 10.24   | 93.88             | 2.81 | 19.81 |
| 4       | Leaf Width (cm) | 4.55    | 7.97    | 6.40  | 0.60                     | 0.65                     | 12.12   | 12.59   | 92.60             | 1.54 | 24.02 |
| 5       | Petiol Lnth (cm)| 2.96    | 7.85    | 5.91  | 1.35                     | 1.40                     | 19.65   | 20.03   | 96.22             | 2.35 | 39.71 |
| 6       | Node No.        | 46.00   | 78.00   | 62.07 | 77.517                   | 85.903                   | 14.18   | 14.93   | 90.24             | 17.23| 27.76 |
| 7       | Base Dia (mm)   | 11.24   | 25.13   | 20.43 | 18.740                   | 18.928                   | 21.19   | 21.30   | 99.01             | 8.87 | 43.44 |
| 8       | Middle Dia (mm) | 6.45    | 13.23   | 10.99 | 3.043                    | 3.194                    | 15.88   | 16.27   | 95.27             | 3.51 | 31.92 |
| 9       | Top Dia (mm)    | 3.14    | 6.77    | 5.02  | 0.620                    | 0.687                    | 15.68   | 16.51   | 90.25             | 1.54 | 30.69 |
| 10      | Core Dia (mm)   | 9.76    | 20.54   | 16.65 | 7.913                    | 8.178                    | 16.90   | 17.18   | 96.76             | 5.70 | 34.24 |
| 11      | Dry Fibre wt. (g)| 7.85    | 19.98   | 16.53 | 7.269                    | 7.491                    | 16.31   | 16.55   | 97.04             | 5.47 | 33.09 |
| 12      | Dry Stick wt. (g)| 17.59   | 56.48   | 46.34 | 63.387                   | 65.772                   | 17.18   | 17.50   | 96.37             | 16.10| 34.74 |

Table 5. Number, percent and name of genotypes in different cluster.

| Cluster number | Number of varieties | Percent (%) | Name of Accessions |
|----------------|---------------------|-------------|--------------------|
| I              | 6                   | 14.29       | Ac 01, Ac 04, Ac 16, Ac 29, Ac 31 and Ac 37 |
| II             | 10                  | 23.81       | Ac 02, Ac 06, Ac 08, Ac 09, Ac 14, Ac 20, Ac 24, Ac 26, Ac 39 and Ac 41 |
| III            | 9                   | 21.43       | Ac 03, Ac 10, Ac 11, Ac 21, Ac 27, Ac 28, Ac 33, Ac 38 and Ac 42 |
| IV             | 5                   | 11.9        | Ac 05, Ac 07, Ac 13, Ac 17 and Ac 40 |
| V              | 12                  | 28.57       | Ac 12, Ac 15, Ac 18, Ac 19, Ac 22, Ac 23, Ac 25, Ac 30, Ac 32, Ac 34, Ac 35 and Ac 36 |

belonged to cluster-III. In the fourth group of divergent clusters consisting of cluster-IV, five genotypes namely serial no. of Ac 05, Ac 07, Ac 13, Ac 17 and Ac 40 belonged to cluster-IV. In the fifth group of divergent clusters consisting of cluster-V, twelve genotypes namely serial no. of Ac 12, Ac 15, Ac 18, Ac 19, Ac 22, Ac 23, Ac 25, Ac 30, Ac 32, Ac 34, Ac 35 and Ac 36 belonged to cluster-V. The diversity in the present
Materials was also supported by the appreciable amount of variation among cluster means for different characters (Table 6). Cluster V showed highest mean for plant height (3.38 m), base diameter (24.44 mm), dry stick weight (52.78 g) and dry fibre weight (18.69 g).

Table 6. Cluster mean for twelve yield and yield characters of *C. capsularis*.

| Characters                  | I     | II    | III   | IV    | V     |
|-----------------------------|-------|-------|-------|-------|-------|
| Tech ht (m)                 | 2.39  | 2.81  | 2.97  | 3.13  | 3.38  |
| Leaf Angl (dg)              | 52.17 | 48.50 | 52.89 | 46.60 | 50.42 |
| Leaf Lnth (cm)              | 12.68 | 12.98 | 14.10 | 14.57 | 15.81 |
| Leaf Width (cm)             | 5.49  | 5.81  | 6.47  | 6.46  | 7.26  |
| Petiol Lnth (cm)            | 4.34  | 5.36  | 5.50  | 6.55  | 7.18  |
| Node No.                    | 51.83 | 54.80 | 59.11 | 69.40 | 72.42 |
| Base Dia (mm)               | 13.16 | 18.72 | 19.97 | 23.78 | 24.44 |
| Middle Dia (mm)             | 8.15  | 9.69  | 11.33 | 12.35 | 12.66 |
| Top Dia (mm)                | 4.05  | 4.63  | 4.79  | 5.07  | 5.99  |
| Core Dia (mm)               | 12.54 | 14.52 | 17.26 | 18.35 | 19.31 |
| Dry Fibre wt. (g)           | 11.24 | 15.83 | 16.93 | 18.40 | 18.69 |
| Dry Stick wt. (g)           | 30.94 | 44.39 | 47.26 | 51.63 | 52.78 |

Figure 1. Dendogram of 42 deshi jute genotypes.
**Conclusion**

The experiment demonstrates that the studied genotypes were highly variable for all of the morpho-agronomic traits and the accessions of *C. capsularis* 628, 633, 635 and 646 performed better in respect of major yield contributing traits than the controls CVE-3, CVL-1, BJC-7370 and BJC-83. Hence it can be concluded that these promising accessions may be used in a hybridization programme, to enhance fibre yield of deshi jute.

**References**

Annual Research Report (2016). Bangladesh Jute Research Institute. Manik Mia Avenue, Dhaka-1207.

Basu A, Ghosh M, Meyer R, Powell W, Basak SL, Sen SK (2004). Analysis of genetic diversity in cultivated jute determined by means of SSR markers and AFLP profiling. *Crop Science*, 44: 678-685.

BBS (2010). Statistical Yearbook of Bangladesh. Bangladesh Bureau of Statistics. Ministry of Planning and Statistics Division, Govt. of People’s Republic of Bangladesh, Dhaka. Website: http://www.bbs.gov.bd

Choudhuri SD, Mia AJ (1962). Species crosses in the genus *Corchorus* (jute plant). *Euphytica*, 11: 61-64.

Edmonds JM (1990). Herbarium survey of African *Corchorus* species. Systematic and Ecogeographic Studies on Crop Gene Pools 4. *International Board for Plant Genetic Resources*.

Ghosh M, Saha T, Nayak P, Sen SK (2002). Genetic transformation by particle bombardment of cultivated jute, *Corchorus capsularis* L. *Plant cell reports*, 20: 936-942.

Haque S, Begum S, Sarker RH, Khan H (2007). Determining genetic diversity of some jute varieties and accessions using RAPD markers. *Plant Tissue Culture and Biotechnology*, 14: 143-148.

Hossain MB, Haque S, Khan H (2002). DNA Fingerprinting of jute germplasm by RAPD. *Journal of Biochemistry and Molecular Biology*, 35: 414-419.

Hossen M, Ali MS, Begum M, Khatton A, Halim A (2008). Study on high yield of quality jute seed production for diversified uses. *Journal of Innovation and Developmental Strategy*, 2: 71-73.

Islam AS, Rashid A (1960) First successful hybrid between the two jute yielding species, *Corchorus olitorius* L. (Tossa) × *C. capsularis* L. (White). *Nature*, 185: 258-259.

Islam MA, Haque MA, Sardar MA (2002). Biology and Parasitism of *Apanteles obliquae* Wilk. (Hymenoptera:Bracidae) on Jute Hairy Caterpillar, *Spilarctia obliqua* (Walk.). *Bangladesh Journal of Entomology*, 13: 12-21.

Islam MA, Ando T (2012). Knowledge and Practice of Pheromone Technologies: A case Study of a Representative District in Bangladesh. *Academic Research International*, 2(2): 55-61.

Islam MA (2012). Pheromone Use for Insect Control: Present Status and Prospect in Bangladesh. *International Journal of Agricultural Research, Innovation and Technology*, 2 (1): 47-55.

Kundu BC (1951). Origin of jute. *Indian J Genet Pl Br*. 11:95- 99 842 Laurentin H (2009) Data analysis for molecular characterization of plant genetic resources. *Genetic Resources and Crop Evolution*, 56: 277-292.

Mir RR, Rustgi S, Sharma S, Singh R, Goyal A, Kumar J, Gaur A, Tyagi AK, Khan H, Sinha MK, Balyan HS, Gupta PK (2008). A preliminary genetic analysis of fiber traits and the use of new genomic SSRs for genetic diversity in jute. *Euphytica*, 161: 413-427.

Mohiuddin G, Rashid M, Rahman M, Hasib SA, Razzaque A (2005). Biopulping of whole jute plant in soda-anthraquinon and kraft processes. *TAPPI J.*, 4: 23-27
Patel GI, Datta RM (1960) Interspecific hybridization between *Corchorus olitorius* and *C. capsularis* and the cytogenetical basis of incompatibility between them. *Euphytica*, 9: 89-110.

Roy A, Bandyopadhyay A, Mahaptra AK, Ghosh SK, Singh NK, Bansal KC, Koundal KR, Mohapatra T (2006). Evaluation of genetic diversity in jute (*Corchorous* species.) using STMS, ISSR and RAPD markers. *Plant Breeding*, 125: 292-297.

Roy SK, Chakraborty, Hijam HM, Mondal HA, Surje DT, Roy A, Mondal A, Pal S, Kundu A. Das S, Sarkar P, Kheroar S, Chakraborty G, Mitra S (2018). Studies on genetic variability and screening for fibre yield components and biotic stress factors in tossa jute (*Corchorus olitorius* L.) germplasm under Terai region of West Bengal. *Electronic Journal of Plant Breeding*, 9 (2): 409-423.

Roy A, Chakraborty G, Roy SK, Mitra S, Sarkar SK (2015). Exploiting plant growth promoting microbes and biopesticides for ecofriendly and cost-effective biotic stress management of *Olitorius Jute* in Terai Region of West Bengal. *Indian Journal of Natural Fibres*, 1(2): 203-11.

Saha T, Majumdar S, Banerjee NS, Sen SK (2001). Development of interspecific somatic hybrid cell lines in cultivated jute and their early characterization using jute chloroplast RFLP marker. *Plant Breeding*, 120: 439-444.

Saunders M (2001). Recovery plan for the endangered native jute species, *Corchorus cunninghamii* F. Muell in Queensland (2001-2006). Natural Heritage Trust, Australia, 221-232.

Sawarkar A, Yumnam S, Patil SG, Mukherjee S (2014). Correlation and path coefficient analysis of yield and its attributing traits in tossa jute (*Corchorus olitorius* L.). *The Bioscan*, 9(2): 883-87.