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Seed Quality of *Corchorus capsularis* in Bangladesh

Ismail Hossain[1*], Sanzida Rahman Satu[1], M. Muniruzzaman Hasan[2], Saleh Mohammad Ashraful Haque[2]

[1]*College of Agricultural Sciences, International University of Business Agriculture and Technology (IUBAT), Dhaka-1230, Bangladesh;*
[2]*Plant Pathology Division, Bangladesh Jute Research Institute (BJRI), Dhaka 1207, Bangladesh.*

Keywords

Germination; Moisture content; Pure seed; Quality Seed; Seed borne fungi.

Abstract

The experiments were carried out at Plant Pathology Department, Bangladesh Jute Research Institute (BJRI), Dhaka, Bangladesh. Fifteen Seed samples of 10 varieties of Corchorus capsularis collected from seven research stations (Kishorganj, Comilla, Jessore, Potuakhali, Manikganj, Dinajpur and Rangpur) of BJRI for evaluating the quality of seeds, where1000-seed weight/sample ranged from 3.05 to 3.67g, the lowest and highest weights were recorded in CVL–1 of Comilla and in Breeder Seed of CVL-1of Manikganj. Highest pure seed (96.40%) recorded in CVL – 1 of Jessore and lowest (89.41%) in Breeder seed CVL – 1 of Manikganj. The Germination of collected seeds varied from 56 to 88%, where the highest and lowest counts were made in CVL - 1 of Rangpur and CVL – 1 of Jessore. The highest (21%) seed yielded fungi per sample of Breeder seed CVL -1 of Manikganj and lowest (6%) in Deshi pat -1 of Potuakhali. The highest ratio (7.3:1) between % seed germination and % seed germination failure found in CVL -1 of Rangpur and lowest ratio (1.2:1) in CVL - 1 of Jessore. Seed borne fungi viz. Macrophomina phaseolina, Botryodiplodia theobromae, Colletotrichum corchori, Aspergillus niger, Aspergillus flavus, and Penicillium Spp. were determined.

1. Introduction

Jute is the one of the most important cash and fiber crop in Bangladesh. Bangladesh is the second biggest jute producer all over the world. Jute fiber is the least expensive fiber and is utilized in the assembling of cordage, gunny fabric, gunny sacks and other bundling materials for agrarian and modern items. *Corchorus capsularis* L. is called deshi pat or white jute and its fiber is usually whitish. As a rule, C. *capsularis* shows adaptability corresponding to dry spell and flood condition. In spite of the fact that it shows high financial significance and its fiber is agreeable to the climate for the delivering nations, the worldwide circumstance is defied with number of issues. The region under jute in Bangladesh is declining and the yield is additionally being pushed increasingly more to the minor grounds. Presently, it is the about time

[*]Corresponding author's E-mail address: ismail.hossain@iubat.edu
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to satisfy up the need of eco-accommodating item by developing more jute and expanding the jute creation. Seed quality should be kept up with during seed putting away. Seed capacity to germinate is one of the basic variables on which the seed quality very depended (Paul, 1975). Level of dampness, and germination were essentially contrasted in various capacities. Albeit few explores was led to keep up with the jute seed quality during stockpiling yet no reports are accessible for longer time of deshi jute seed putting away. Thus, the experiment was directed to find out seed quality of jute on expanded capacity period. Jute, known as the brilliant fiber, is a significant customary money crop in Bangladesh. As a matter of fact, jute is the second most significant natural fiber with regards to worldwide utilization after cotton that contributed lion share to the economy of Bangladesh (Annonymous, 2006).

However, the seed quality of *C. capsulais* is not high enough comparable with other countries of the world, even lower than the seed quality of India. The seed quality depends on different factors like seed viability, vigour, moisture level, storing systems and diseases (Fakir 2001). Matthews *et al.* (2012) studied the quality of seeds of *Capsularis* and reported that Seed quality standards enable seed users to achieve their objectives in the establishment of uniform seedlings to a high and reliable level for a range of agricultural and horticultural crops, growing systems and market outlets. The seed borne pathogens viz. *Macrophomina phaseolina, Botryodiplodia theobromae, Colletotrichum corchori, Rhizoctonia solani, Phomopsis* spp., *Sclerotium rolfsii, Curvularia lunata*), *Corynespora cassicola* and *Cercospora corchori*. One of the most important problems for jute production in Bangladesh is the non-availability of quality seed at proper time of sowing. Only about 15 - 20% quality jute seeds are supplied by institutional sources however the rest amount of quality seeds yet to be managed to supply (Islam & Uddin 2019). These are the causes of seed and field diseases and deteriorate seed quality, decrease quality and yield of fibers. Therefore, it is an urgent need to study the seed quality of jute in Bangladesh. Considering the above circumstances, this research was carried out to find out the quality of seed of *Corchorus capsularis* in Bangladesh.

2. Materials and Methods

2.1. Experimental Site and Period

The experiments were conducted at Plant Pathology Department, BJRI, Manik Mia Avenue, Dhaka, Bangladesh during the period from August, 2022 to July, 2023.

2.2 Collection of Seed Samples

Seed samples of *C. capsularis* were collected from seven different Research stations of Bangladesh Jute Research Institute for the study. The locations were Kishorganj, Comilla, Jessore, Potuakhali, Manikganj, Dinajpur and Rangpur. Primary seed sample of 30g for each sample were randomly taken from 10 different positions of the seed lot. All the primary seed samples were mixed thoroughly to make a composite sample. All the seed samples were labeled properly and preserved properly until the samples were used for the study. Working seed samples were

taken from the preserved seed samples as per requirement. Seed collection procedure was maintained following the rules of ISTA (2019).

2.3. Determination of Seed Quality

Tests for determining seed quality were conducted following the method as described below:

2.3.1. Determination of 1000 - Seed Weight

For weight determination the 1000 - seeds of jute was randomly counted for each pure seed sample and measured in an electronic balance (Model- PC- 180).

2.3.2. Determination of Seed Moisture Content

Seed moisture was determined by following oven dry method (Haque *et al.* 2014). The moisture content of the seed samples was calculated by means of the following formula:

$MC\ (\%) = (M_2 - M_3)\ X\ 100/\ (M_2 - M_1)$

MC = Moisture Content, M_1 = Weight in grams of container and its cover/lid

M_2 =Weight in grams of the container, its cover and its contents before drying

M_3 = Weight in grams of the container, cover and contents after drying.

2.3.3. Seed Germination

Seeds (1000 seeds / sample) were taken randomly from the well mixed seed sample (Haque 2014). The seeds from working samples were placed on Filter paper Whatman No.1. The seeds were germinated on top of three layers of Whatman No. 1 filter paper. The filter papers were soaked in water and placed at the bottom of 9 cm diameter plastic petridish and thereafter 25 seeds/plate were placed on the top of filter paper following ISTA (2019). The petridishes were placed inside the incubator at 30^0C for five days. Seeds producing both plumule and radical after incubation were counted as germinating seeds.

2.3.4. Seed Purity

This test was carried out following the method of ISTA (2019), where the seeds were graded in four different components viz. i) Pure seed, ii) other crop seed, iii) weed seed and iv) inert matter. The purity of the components was calculated and expressed in percentage.

2.3.5. Detection of Seed Borne Fungi of Seeds

Seed analysis was conducted by blotter method following the International Rules for Seed Health Testing (ISTA, 2019). The presence of seed borne fungi was identified by observing their growth characteristics on the incubated seeds in blotter under stereomicroscope at 25X magnification. If there were any difficulty for identification of fungi, temporary slides were prepared and the fungi were identified

accordingly (Akanda & Fakir, 1985; Fakir 1989; Mathur & Kongsdal, 2003; Melone & Muskett, 1964).

Data were analyzed statistically and treatments effects were compared by Duncan's Multiple Range Test (DMRT) following Gomez & Gomez (1984). Moreover, ratio between % seed germination and % seed germination failure as well as ratio between % seed germination and % seed yielding fungi analyzed.

3. Results and Discussion

The findings of the present study have been analyzed, compared and presented using Tables 1-5. 1000-seed weight of the tested materials ranged from 3.051 to 3.674g, where the lowest and highest weights were recorded in CVL–1 of Comilla and in Breeder Seed CVL-1 of Manikganj respectively (Table 1). Haque *et al.* 2014 reported that 1000-seed weight ranged from 1.60 – 1.90g. That indicating the improvement of seed size as a result weight of seeds increased. The moisture content of seed varied from 8.5 to 11.9%, where the lowest and highest counts were recorded in seeds of Deshi pat-1 of Potuakhali and in Deshi pat-5 of Comilla, respectively (Table 1). Haque *et al.* (2014) recorded 11.67 – 15.43% moisture content in case of farmer's seed that depends on the storing containers. They also reported that the moisture content of five different tier seeds viz. Breeder seed, Foundation seed, Certified seed, Farmer seeds and NGO seed of O-9897 ranged from 10.32 to 11.59%.

Under purity test seed sample of each variety under each location were separated into four components such as (a) pure seed, (b) seeds of other crops, (c) weed seeds and (d) inert matter. The pure seed of different locations ranged from 89.41 to 96.40%, where the highest data was recorded in CVL – 1 of Jessore and lowest count was found in Breeder seed CVL – 1 of Manikganj as shown in Table 2. Haque *et al.* (2014 and 2016) recorded 91.21 - 99.85% pure seed in O-9897. Purity test is considered as an essential technique for determining the quality of seed (Annonymous, 2009). Matthews *et al.* (2012) studied the quality of seeds of *Capsularis* and reported that Seed quality standards enable seed users to achieve their objectives in the establishment of uniform seedlings to a high and reliable level for a range of agricultural and horticultural crops, growing systems and market outlets.

Germination of seeds ranged from 56 to 88%, where highest and lowest germination of seeds were recorded in case of seeds of CVL -1 of Rangpur and in CVL -1 of Jessore, respectively (Table 3). Haque *et al*. (2014) found 68.00 – 89.33% germination in their research program on status of quality and health of Jute seed of variety O-9897 in Bangladesh.

Altogether 1000 seeds of each variety/ location for each replication were tested for determining seed borne fungi. It was found that seed borne fungi had grown from a range of 6 to 21% seeds (Table 4). That variation was recorded from testing seeds of seven locations. The Breeder seed (CVL -1) of Manikganj resulted highest 21% seed infection by the fungus, whereas the lowest (6%) count was

recorded in case of seed samples of Deshi pat -1 of Potuakhali and in CVL -1 and BJC -7370 of Rangpur. Haque *et al.* (2014) recorded 25.23 – 90.65% seed infected by seed borne pathogens. Fakir (1989) also reported seed borne fungi of jute that caused diseases of jute by those fungi.

The findings on the ratio between % seed germination and % seed fail to germinate of each sample / location is shown in Table 5. It is interestingly found that the highest ratio (7.3:1) between % seed germination and % seed fail to germinate was found in Rangpur (CVL -1) and lowest (1.2:1) was recorded in Jessore (CVL -1). Another study was conducted to find out ratio between % seed germination and % seed yielding fungi, where the highest ratio (14.7:1) was recorded in Rangpur (CVL -1) and lowest (3.1:1) in Manikgonj (Breeder seed CVL -1). The seed borne fungi viz. *Aspergillus nizer, A. flavus, Rhizopus stolonifers* and *Penicillium*spp were found abundantly, *Colletotrichum corchori, Macrophomina phaseolina* and *Botryodiplodia theobromae* were also recorded. This is accordance with the report of Fakir (1989).

Infected jute seed fail to germinate or young seedlings emerging from the infected seed die due to germination failure, post emergence damping off and seedling blight (Fakir, 1989). Fakir (2001) also reported *Macrophomina phaseolina* (Stem rot), *Botryodiplodia theobromae* (Black band), *Colletotrichum corchori* (Anthracnose), *Rhizoctonia solani* (Foot rot/Wilting), *Phomopsis* spp. (Germination failure), *Sclerotium rolfsii* (Soft rot), *Curvularia lunata* (Seed rot), *Corynespora cassicola* (Target Spot) and *Cercospora corchori* (Leaf spot). These are the causes of seed and field diseases and deteriorate seed quality and decrease yield of fibers. Haque (2016) reported that the quality seed largely dependent on seed borne fungi causing diseases to seed as well as in the field. Therefore, it is an urgent need to upgrade the seed quality of jute, *C. capsularis* (Deshi Pat) in Bangladesh.

Conclusion

Seed samples of 10 varieties (CVL -1, BJC-2197, BJC-7370, Deshi pat -1, Deshi pat-5, Deshi pat-8, Deshi Pat-9, Deshi pat-10, Breeder Seed CVL-1 and Breeder Seed Deshi pat 9 of *C. capsularis* collected from seven Research Stations (Kishorganj, Comilla, Jessore, Potuakhali, Manikganj, Dinajpur and Rangpur) of BJRI. 1000-seed weight of the tested materials ranged from 3.051 to 3.674g, moisture content varied from 8.5 to 11.9% and pure seed ranged from 89.41 to 96.40%, but the Germination varied from 56 to 88%. Contrary 6 to 21% seeds had seed borne fungi viz. *Macrophomina phaseolina, Botryodiplodia theobromae, Colletotrichum corchori, Aspergillus niger, A. flavus,* and *Penicillium Spp*..The seed borne pathogens caused different types diseases and resulting germination failure, deterioration of seeds and seedlings. Moreover, seed borne pathogens are also potential source of different diseases of jute in the field. As a result, deterioration of fiber quality as well as yield of fiber decreased. So, quality of seed is an indispensible and utmost important means of successful jute production in the country. The present investigation has clearly point out the status of seed quality of *Corchorus capsularis* in Bangladesh. Therefore, it may be concluded that jute seed,

especially seeds of *Corchorus capsularis* in Bangladesh are not good quality. The quality of seeds is required to be upgraded for bumper cultivation of jute, *Corchorus capsularis* in Bangladesh.

Table 1: Location of collection of seeds of different varieties of *Corchorus capsularis* along with 1000-Seed Weight and Moisture content

Serial No.	Varity (Collection of location)	1000-Seed Weight (g)*	Seed moisture (%) *
1	Deshi pat -1(Kishorganj)	3.360	11.3
2	Deshi pat-5(Comilla)	3.570	11.9
3	CVL -1(Jessore)	3.363	11.0
4	Deshi pat-8 (Jessore)	3.434	10.6
5	CVL-1(Comilla)	3.674	10.1
6	Deshi pat-10 (Potuakhali)	3.490	10.3
7	Deshi pat-1(Potuakhali)	3.183	8.5
8	Deshi Pat- 8 (Potuakhali)	3.370	9.9
9	Breeder Seed CVL-1 (Manikganj)	3.051	10.0
10	Breeder Seed Deshi Pat-9 (Manikganj)	3.304	9.8
11	BJC-7370 (Dinajpur)	3.634	10.6
12	BJC-2197 (Dinajpur)	3.743	10.3
13	Deshi Pat- 9(Rangpur)	3.510	10.6
14	CVL-1 (Rangpur)	3.521	10.6
15	BJC-7370 (Rangpur)	3.266	11.3
	Total	51.473	
	Mean	3.431	
	Standard deviation	0.188	

*Data represents the mean of three replication

Table 02: Purity Test of seeds of different varieties of *Corchorus capsularis* collected from different locations

Serial No.	Variety (Collection of location)	Weight total tested seed (g)	Weight pure seed (g)	Weight of Seeds of other crops (g)	Weight of Inert matter (g)	% Pure seed

1	Deshi pat – 1(Kishorganj)	20.920	20.027	0.676	0.217	95.73
2	Deshi pat-5 (Comilla)	19.280	17.935	0.744	0.601	93.02
3	CVL -1(Jessore)	18.542	17.876	0.438	0.228	96.40
4	Deshi pat-8 (Jessore)	22.749	21.851	0.605	0.293	96.52
5	CVL-1(Comilla)	22.169	20.210	1.693	0.404	91.16
6	Deshi pat-10 (Potuakhali)	22.559	20.523	1.654	0.404	90.97
7	Deshi pat-1(Potuakhali)	22.272	20.514	1.375	0.383	92.10
8	Deshi Pat- 8 (Potuakhali)	23.809	21.950	1.675	0.184	92.19
9	Breeder Seed CVL-1 (Manikganj)	24.366	21.788	2.1940	0.384	89.41
10	Breeder Seed Deshi Pat-9 (Manikganj)	18.243	17.243	0.717	0.449	93.60
11	BJC-7370 (Dinajpur)	18.243	17.243	0.717	0.449	93.60
12	BJC-2197 (Dinajpur)	24.453	22.954	0.777	0.731	93.83
13	Deshi Pat-9(Rangpur)	18.844	17.150	0.905	0.789	91.01
14	CVL-1 (Rangpur)	19.13	17.196	1.064	0.870	89. 89
15	BJC-7370 (Rangpur)	28. 877	27.438	0.654	0.785	95.01

Table 3: Location of collection of seeds of different varieties of *Corchorus capsularis* along with number of seed tested/ sample, % Germination of seed / sample and Mean Germination (%)

Serial No.	**Varity (Collection of location)**	**%Germination of seed / sample**				**%Mean Germination)**
		1	**2**	**3**	**4**	
1	Deshi pat -1(Kishorganj)	64	80	72	68	71 cd
2	Deshi pat-5(Comilla)	76	80	76	72	76bcd

3	CVL -1(Jessore)	52	60	64	48	56f
4	Deshi pat-8 (Jessore)	76	84	72	88	80abcd
5	CVL-1(Comilla)	76	80	84	60	75 cd
6	Deshi pat-10 (Potuakhali)	84	60	72	88	76bcd
7	Deshi pat-1(Potuakhali)	72	80	76	68	74cde
8	Deshi Pat- 8 (Potuakhali)	80	84	72	76	78abcd
9	Breeder Seed CVL-1 (Manikganj)	60	64	60	68	63ef
10	Breeder Seed Deshi Pat-9 (Manikganj)	80	84	88	80	83abc
11	BJC-7370 (Dinajpur)	68	72	64	72	68 cd
12	BJC-2197 (Dinajpur)	84	76	68	72	75bcd
13	Deshi Pat- 9(Rangpur)	92	80	100	76	87 ab
14	CVL-1 (Rangpur)	92	92	88	80	88 a
15	BJC-7370 (Rangpur)	72	72	80	84	77abcd

1000 seeds/ sample were tested.

Data in column having similar letter(s) do not differ significantly at 0.01 levels (DMRT).

Table 4: Location of collection of seeds of different varieties of *Corchorus capsularis* along with number of seed tested/ sample, No. of seed yielding fungus / sample and % Seed yielding fungus / Sample

Serial No.	Variety (Collection of location)	No. of seed yielding fungus / sample				% Seed yielding fungi / Sample
		1	**2**	**3**	**4**	
1	Deshi pat -1(Kishorganj)	120	160	200	120	15b
2	Deshi pat-5(Comilla)	80	120	80	280	14 b
3	CVL -1(Jessore)	120	120	160	80	12 b
4	Deshi pat-8 (Jessore)	80	80	80	80	8 c
5	CVL-1(Comilla)	40	80	120	120	9 c
6	Deshi pat-10 (Potuakhali)	80	80	120	40	8 c
7	Deshi pat-1(Potuakhali)	120	40	40	40	6 c
8	Deshi Pat- 8 (Potuakhali)	40	120	80	40	7 c
9	Breeder Seed CVL-1(Manikganj)	200	120	280	240	21 a

10	Breeder Seed Deshi Pat-9 (Manikganj)	40	240	160	80	13 b
11	BJC-7370 (Dinajpur)	200	320	80	40	16 b
12	BJC-2197 (Dinajpur)	160	240	200	280	20 a
13	Deshi Pat- 9(Rangpur)	40	40	100	180	9 c
14	CVL-1 (Rangpur)	40	40	40	120	6 c
15	BJC-7370 (Rangpur)	40	80	40	80	6 c

Data in column having similar letter(s) do not differ significantly at 0.05 levels (DMRT).

Table 5: Location of collection of seeds of different varieties of *Corchorus capsularis* along with % Seed Germination/ sample/ location, % Seed fail to germinate / sample/ location, % Seed yielding fungus / sample/ location, Ratio between % seed germination and % seed germination failure and Ratio between % seed germination and % seed yielding fungi

Serial No.	Variety (Collection of location)	% Seed Germination/ location	% Seed fail to germinate / sample/ location	% Seed yielding fungus / sample/ location	Ratio between % seed germination and % seed germination failure	Ratio between % seed germination and % seed yielding fungi
1	Deshi pat - 1(Kishorganj)	71	29	15	2.4:1	4.7:1
2	Deshi pat- 5(Comilla)	76	24	14	3.1: 1	5.4:1
3	CVL -1(Jessore)	56	44	12	1.2: 1	4.7:1
4	Deshi pat-8 (Jessore)	80	20	8	4:1	10:1
5	CVL-1(Comilla)	75	25	9	3:1	8.3:1
6	Deshi pat-10 (Potuakhali)	76	24	8	3.1:1	9.5:1
7	Deshi pat- 1(Potuakhali)	74	26	6	2.8:1	12.3:1
8	Deshi Pat- 8 (Potuakhali)	78	22	7	3.5:1	11.1:1

9	Breeder Seed CVL-1 (Manikganj)	63	37	21	1.7:1	3:1
10	Breeder Seed Deshi Pat-9 (Manikganj)	83	24	13	3.5:1	6.4:1
11	BJC-7370 (Dinajpur)	68	32	16	2.1:1	4.3:1
12	BJC-2197 (Dinajpur)	75	25	20	3:1	3.8:1
13	Deshi Pat-9(Rangpur)	87	13	9	6.7:1	9.7:1
14	CVL-1 (Rangpur)	88	12	6	7.3:1	14.7:1
15	BJC-7370 (Rangpur)	77	23	6	3.3:1	12.8:1

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Conflict of interest

The Authors declare no conflict of interest regarding the publication of the work. Further, the authors have witnessed ethical considerations including plagiarism, informed consent, misconduct, data fabrication and / or falsification, double publication and / or submission and redundancy.

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