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Development of Two Tossa Jute Mutants for Higher Fiber Yield Through Mutation Breeding

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ABSTRACT

The demand for jute fiber is increasing instead of synthetic fiber nowadays. Developing an early and high fiber-yielding tossa jute line is the main breeding objective of jute growing areas including Bangladesh. To fulfill that objective, the existing cultivar JRO-524 was irradiated with five (700, 800, 900, and 1000 gy) doses of gamma-ray. A total of 25 M_3 plants were first selected from bulked M_2 plants. Two years of replicated yield trial experiments were conducted in different locations in Bangladesh. Among them, two mutants BJM-10-1-3 and BJM-10-1-5 were selected for higher fiber and stick yield. The selected mutants BJM-10-1-3 and BJM-10-1-5 showed 4% to 6% higher yield than their parent JRO-524. The mutant line BJM-10-1-5 showed higher fiber percentage (34.04%), fiber fitness (2.65%), and fiber brightness (44.15%). These two mutants have been under participatory varietal trial (PVT) for evaluation to release a tossa jute variety. These lines will play a vital role in reducing the seed import of variety JRO-524 from India.

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INTRODUCTION

Jute is an herbaceous annual fiber crop bearing chromosome number 2n=2x=14 is an important fibre yielding crop of Bangladesh belongs to the family Tiliaceae (Basu, 1967 and Mukul and Akter, 2021). Two type of jute *C. capsularis* L. and *C. olitorius* L. extensively cultivated in south Asian countries and produce high quality fiber (Sarker et al, 2017). Bangladesh produces 35% of the total world production, 90% of total raw jute exports with 60% jute products (Molla, 2014). It is considered as golden fiber of Bangladesh because it contributed the major portion to the economy. Jute fiber is used for making gunny bags, sacking, carpet backing cloths, mats blankets, furnishing fabrics and packing materials as an alternative to polyethyline bags (Islam et al, 2011). The main challenge of developing *C. olitorius* varieties are narrow genetics base, possibilities of out-crossing (8–12%) (Kar et al., 2009). Fiber yield of Jute relies on two crucial parameters plant height, leaf architecture, rooting pattern and base diameter (Islam, 1995). The tall plant, non-branching, less shattering and lodging tolerant is the desired morpho-physiological characteristics for higher fiber yield (Maity et al., 2012). The another hindrance of jute cultivation is farmers are rely on the exotic jute variety and shortage in supply of quality seed against its requirement for sowing, which influence negatively the expansion of jute cultivation in Bangladesh (Akter et al, 2020)

The lower quality of jute fibers compare to other fiber crops due to greater levels of lignin in its fiber (greater than ramie and cotton), creating it less appropriate for creating finer textiles and other value-added goods (Loumerem and Alercia, 2016). The lignin content in existing varieties of jute varies from 12-14% (Sengupta and Palit, 2004). JRO-524 is a popular dark jute variety which is developed from African (cv. Sudan Green) and the main morphological feature of this variety is free of pre-maturing flowering, short duration, good fiber quality and non-shattering pod. The retting procedure of JRO-524 is better than other olitorius varieties and extraction is easy (Rahman, 2019).

The main challenges of the variety JRO-524 is low yield and seed unavailability to the famer due to exotic variety (Benor, 2012). The fiber gained from seed crop will be poor in quality. In Bangladesh context, it is essential to develop jute variety having higher seed production ability without compromising fibre and stick quality traits. Mutation breeding is the best way to create variability in jute crop because it's narrow genetic base. There was an extensive application of physical mutagens such as gamma-ray to obtain genetic variations within a short period of time and (Thakare et al. 1973). Low lignin and high fiber and stick yield was found in several studies through mutation breeding (Acquaah G, 2012). The aim of this article is to develop Tossa jute mutants with high yielding quality fibre and stick, short duration which will reduce the dependency from abroad.

MATERIALS AND METHODS

To improve the Tossa Jute variety JRO-524, dry seeds of JRO-524 were irradiated with 700, 800, 900 and 1000 Gy doses of gamma rays. In M_2 generation, no lines were selection due to lack of morphological variation observed in different doses of irradiation. Twenty five lines were selected in M_3 generation. In M_4 generation non-replicated trail was conducted at BINA HQ where eight mutants had been selected in term of fiber yield and other morpho-physiological characters. In Mymensigh, Magura and Rangpur, replicated trial was conducted in M_5 and M_6 generation Plants were planted in 5-7 cm distances within rows of 30 cm apart. A unit plot size was 4m × 3m. Recommended doses of nitrogen, phosphorus, potassium, sulphur and zinc were applied in the form of Urea, TSP, MoP, Gypsum and Zinc Sulphate. Cultural and intercultural practices were followed as and when necessitated. At harvest, data on plant height and base diameter were recorded from 10 randomly selected plants but dry fiber and stick weights were recorded also from selected 10 plants after proper sun drying which later converted to g plant^{-1}.

Experimental sites

The study was conducted at below locations i.e. Magura [23°29' 27.37'' N and 89° 25' 16.08'' E], Faridpur [23°35'23.2"N 89°48'43.1"E], Rangpur [25°44'33.7"N 89°16'21.8"E], Jamalpur [24° 55' 22.89'' N 89° 57' 0.3996'' E] districts of Bangladesh for three fiscal years (2019-20 and 2020-21). The Distinctness, Uniformity and Stability (DUS) test was carried out at Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh (24° 44' 36.41'' N 90° 23' 54.18'' E)

Method of data collection

The selected lines and check were harvested at 95-105 Days after sowing (DAS) and morphological data (Plant height, base diameter, green weight with and without leaves) were taken. The plants were bundled according to plot with proper tagging and allowed to shedding of leaves. After shedding of leaves, the bundles were steeped in fresh water for 20–22 days, and fibers were extracted after retting. The extracted jute fibers were carefully washed in clean water, and dried on grass field or by hanging on bamboo poles. The weight of dry fibers and sticks were recorded carefully.

Table 1. Measurement of morphological traits

SL.	Traits and measurement units	Procedure of measurement
1.	Plant height (m)	The average height of 5 plants selected randomly
2.	Base diameter or girth of the plant (mm)	The average base diameter of 5 plants selected randomly
3.	Green weight with leaves (t ha^{-1})	Total plants weight with leaves after immediate harvest
4.	Green weight without leaves (t ha^{-1})	Total plants weight without leaves after immediate harvest
5.	Dry fibre yield (t ha^{-1})	Total weight of dry fiber produced
6.	Dry stick yield (t ha^{-1})	Total weight of dry stick produced

Stem rot artificial inoculation procedure

All the three inoculation methods (stem, root and leaves) were evaluated in 30 day old plants grown in pots (45 cm diameter) containing sterilized sandy loam soil (pH 6.5 - 7.5) during normal growing season of jute in April to July, 2023-24 in Plant Pathology lab, Bangladesh Institute of Nuclear Agriculture (BINA). Inoculum was prepared aseptically by mycelial bit taken from a 3 day old freshly grown culture of M. phaseolina on potato dextrose broth at 28+1^{o}C for 5 days. The mycelial mat was filtered and used as inoculum for leaf or soil or stem inoculation. Inoculum density was 3.7×102 colony forming units per g at the time of inoculation.

Measurement of jute fiber quality data

Finenss/fitness of jute fiber

According to Bandyopadhyay and Sinha, 1968, it is a measure of the diameter (width) or weight per unit length of fibre filament. The jute fiber fineness can be assessed by using microscope mean very fine fiber (<3), fine fiber (3–3.9), average fine fibre (4–4.9), coarser (5–5.9) and very coarser (≥6.0) fibre. By following this methods, MIC value of of BJM-10-1-3 and BJM-10-1-5 ranges from 2.63-2.65 indicating very fine fibre

Lusture or brightness of jute fiber

The luster of a single fiber is determined by the total visual appearance of these reflections from the fiber surface. It is directly proportional to the amount of light reflected by a fiber. Luster of the fabric is the most vital point. The attraction of the fabric depends on the luster of the fabric. It is measured by fibre brightness or lusture machine. Comparatively lusture content is higher in tossa jute fiber than white jute according to previous research results. The value of brightness of fiber ranges from 43.11-44.15 showing greater brightness.

Estimation of fiber percentage

Physical properties including jute fiber content estimation can be described by IJIRA, 2012. The average value of higher fiber content is 30-33%.

Estimation of fiber strength

Fibre bundle strength can be measured in two methods: i) Stelo meter (strength-elongation meter) and ii) Pressley (based on pivoted beam balance). This is expressed in g $denier^{-1}$, g tex^{-1}, newton tex^{-1}, CN tex^{-1}, lbs mg^{-1} etc. (Roy and Bhattacharya, 2004). The single fibre strengths (gf/tex HVI strength) were graded as very strong (≥31), strong (29–30), average (26–28), intermediate (24–25) and weak (≤23; and fibre bundle strengths (gf/tex) are very strong (≥41), strong (31–40), average (21–30), intermediate (11–20) and weak (≤5.0). It is measured by the Pressley Fiber Bundle Strength

Tester and Fiber Bundle Strength Tester. The jute fibre bundle strength can estimated using the formulae (eqn. iii-v) as follows:

Fiber strength can be calculated by the following formulae:

Pressley Index (PI) = Breaking load in pounds (lbs) / Bundle weight in milligram (mg)

Tenacity (g tex^{-1}) = 0.981 CN tex^{-1} = Breaking length in kilometers = 9 × tenacity in g $denier^{-1}$ = 0.671 × breaking stress in 10^8 dyne cm^{-2}

Experimental design

Experiments were conducted in randomized complete block (RCB) design with 3 replications keeping plot size of 13.5 m^2 (4.5 m × 3.0 m) in PYT and 10 m^2 (4.0 × 2.5 m) in AYT (Gupta et al., 2016). Location wise average data of seed yield and quality attributing characters were analyzed with the help of computer statistical package (MSTAT). The mean differences among the treatments were adjusted as per Duncan's Multiple Range Test (DMRT) and T-test at 0.05 levels (Gomez and Gomez, 1984).

RESULTS

Selection in M_3 generation

With a view to select plants with short duration high fiber and stick yield, seeds of twenty five M_3 populations of JRO-524; 4 from 700 Gray, 6 from 800 Gray, 5 from 900 Gray and 10 from 1000 Gray along with the parent JRO-524

Performance of selected mutants in M_4 and M_5 generation

In M_4 generation, the mutants JRO-524-1000-8, JRO-524-1000-9, JRO-524-1000-10 and JRO-524-700-3 had significantly longer plant height than as well as broader base diameter (Table 2). In term of fiber yield, the mutants JRO-524-1000-8, JRO-524-1000-9 and JRO-524-700-3 had significantly higher fiber and stick weight (Table 1). Finally, the mutants JRO-524-1000-8 and JRO-524-1000-9, JRO-524-1000-10 and JRO-524-700-3 that showed either significantly longer plant height or dry fiber or stick yield will be put into preliminary yield trial in the next growing season.

In M_5 generation, Results showed significant variations among the mutants and check for most of the characters in individual locations and combined over locations. On average, it was observed that plant height of the mutant JRO-1000-8, BJM-10-1-3, BJM-10-1-5 and JRO-524-700-3 was recorded ranged from 3.44 to 3.62 m. The mutants BJM-10-1-3 had significantly longer plant height than the parent JRO-524, although, BJM-10-1-3, BJM-10-1-5 and JRO-524-700-3 none of the mutants had broader base diameter (Table 3). For green weight with leaves and green weight without leaves the mutants are not significantly lower than JRO-524 parents. For dry fibre yield BJM-10-1-3 and BJM-10-1-5 had significantly higher than the parent JRO-524. Again stick yield the mutant BJm-10-1-3 and BJM-10-1-5 had significantly higher than the parent JRO-524. Plant height showed much variation for changing of locations but base diameter a little although the dry fiber and stick yields had some more variations than base diameter (Table 3). Finally, the mutants BJM-10-1-3 and BJM-10-1-5 that showed either significantly longer plant height or dry fiber or stick yield will be put into Advance Yield Trial in the next growing season.

Table 2. Yield and yield contributing characters of eight mutants of JRO-524 in M_4 generation during 2018-19

Mutants/variety	Plant height (cm)	Base diameter (cm)	Fiber yield $plant^{-1}$ (gm)	Stick weight $plant^{-1}$ (gm)
JRO-524-1000-1	313±28	1.53±0.13	76±6	173±15
JRO-524-1000-5	324±23	1.51±0.16	73±2	189±9
JRO-524-1000-8	345±25	1.72±0.07	103±4	242±15
JRO-524-1000-9	345±29	1.68±0.23	115±6	250±14
JRO-524-1000-10	338±25	1.64±0.19	86±5	186±13
JRO-524-700-3	343±19	1.29±0.14	91±5	187±23
JRO-524-800-3	320±21	1.46±0.03	80±6	171±15
JRO-524-800-7	326±22	1.55±0.11	87±3	204±8
JRO-524(P)	322±24	1.56±0.09	83±4	208±16
LSD(0.05)	6.0	0.17	4.22	9.12

Table 3. Yield and yield components of jute mutants in M_5 generation during 2019-20

Location	Mutant/ Variety	Plant height (m)	Base diameter (cm)	Green weight with leaves (Kg)	Green weight without leaves (Kg)	Stick weight (Kg)	Fibre weight (kg)
BINA Substation, Magura	JR0-1000-8	3.88 b	1.54 b	3.07 a	2.00 a	0.33 b	0.19 b
	BJM-10-1-3	3.97 a	1.69 a	3.00 ab	2.07 a	0.50 a	0.24 a
	BJM-10-1-5	3.52 f	1.66 a	2.43 c	2.17 a	0.32 b	0.19 b
	JR0-700-3	3.64 e	1.58 ab	2.67 bc	1.80 a	0.33 b	0.17 bc
	JR0-524	3.82 c	1.57 ab	2.80 ab	1.83 a	0.33 b	0.14 c
	BJRI Tosa Pat-8	3.80 d	1.59 ab	2.93 ab	2.10 a	0.31 b	0.20 ab
BINA Substation, Rangpur	JR0-1000-8	3.53 bc	1.51 b	3.43 ab	2.90 a	0.30 c	0.54 c
	BJM-10-1-3	3.46 bc	1.66 a	3.07 b	2.87 a	0.50 a	0.62 b
	BJM-10-1-5	3.42 c	1.61 ab	3.10 b	2.73 a	0.36 b	0.65 a
	JR0-700-3	3.51 bc	1.58 ab	3.23 b	2.70 a	0.33 bc	0.52 c
	JR0-524	3.58 b	1.47 b	3.43 ab	3.17 a	0.34 bc	0.60 b
	BJRI Tosa Pat-8	3.72 a	1.60 ab	3.77 a	3.37 a	0.32 bc	0.60 b
BINA Headquarter, Mymensingh	JR0-1000-8	3.21 a	0.84 b	5.03 b	1.87 a	0.60 b	0.30 b
	BJM-10-1-3	3.45 a	1.21 a	4.36 bc	2.04 a	0.70 ab	0.37 ab
	BJM-10-1-5	3.38 a	1.24 a	5.53 ab	2.00 a	0.93 a	0.41a
	JR0-700-3	3.36 a	1.28 a	4.72 bc	1.73 a	0.71 ab	0.33 ab
	JR0-524	3.18 a	1.22 a	6.55 a	1.85 a	0.75 ab	0.35 ab
	BJRI Tosa Pat-8	3.21 a	1.40 a	3.50 c	1.93 a	0.70 ab	0.29 b
Combined mean over location	JR0-1000-8	3.54 a	1.30 a	3.84 a	2.25 ab	0.41 b	0.35 b
	BJM-10-1-3	3.62 a	1.52 a	3.48 a	2.32 ab	0.57 a	0.41 a
	BJM-10-1-5	3.44 a	1.51 a	3.69 a	2.30 ab	0.54 ab	0.42 a
	JR0-700-3	3.50 a	1.48 a	3.54 a	2.07 b	0.46 ab	0.33 b
	JR0-524	3.53 a	1.43 a	4.26 a	2.28 ab	0.48 ab	0.37 ab
	BJRI Tosa Pat-8	3.58 a	1.53 a	3.40 a	2.47 a	0.45 ab	0.37 ab

In a column, values with same letter (s) for individual location/ combined means do not differ significantly at 5% level

Fiber yield and yield components of M_6 mutants

Results showed significant variations among the mutants and check for most of the characters in individual locations and combined over locations. On average, it was observed that plant height of the mutant BJM-10-1-3 & BJM-10-1-5 was recorded ranged from 314.1 to 316.71 cm. The mutants BJM-10-1-3 & BJM-10-1-5 had significantly lower plant height than the parent BJRI TosaPat-8. In addition, BJM-10-1-3 & BJM-10-1-5 mutants had broader base diameter contrasting to the parent JRO-524 (Table 3). The mutants BJM-10-1-3 & BJM-10-1-5 had significantly higher green weight with leaves than JRO-524 parent and BJRI Tosa Pat-8. For dry fiber yield, BJM-10-1-3 & BJM-10-1-5 had significantly higher than the parent JRO-524 (Figure 1). Stick yield of BJM-10-1-3 and BJM-10-15 were significantly maximum than the parent. Finally, the mutants BJM-10-1-3 and BJM-10-1-5 that showed either significantly shorter plant height and higher dry fiber or stick yield comparing to parent JRO-524 will be put into next Trial in the upcoming growing season.

Table 4. Yield and yield components of jute mutants with check varieties at different locations during 2020-21

Location	Mutant	Plant height (m)	Base diameter (cm)	Green weight with leaves (Kg)	Green weight without leaves (Kg)	Stick weight (Kg)	Fibre weight (kg)
Magura Substation, BINA	BJM-10-1-3	333.00c	1.48b	5.03	3.16b	0.95ab	0.46a
	BJM-10-1-5	336.67bc	1.61a	5.67	3.72a	1.08a	0.44b
	JRO-524	363.67a	1.36b	5.83	3.70ab	0.97ab	0.43ab
	BJRI Tosa Pat-8	353.67ab	1.45b	5.9	3.66ab	0.93b	0.43ab
MaguraFarmer's Field	BJM-10-1-3	312.4	1.68	4.26	2.33	0.54b	0.28b
	BJM-10-1-5	305.6	1.70	4.76	2.53	0.65a	0.30ab
	JRO-524	295.67	1.70	4.1	2.33	0.55b	0.34a
	BJRI Tosa Pat-8	298.6	1.65	4.2	2.53	0.57b	0.28b
Faridpur Farmer's field	BJM-10-1-3	321.87b	1.42	4.73	3.30bc	0.79a	0.35
	BJM-10-1-5	331.80ab	1.44	4.9	3.32b	0.71ab	0.34
	JRO-524	326.33ab	1.50	4.66	2.94c	0.67b	0.34
	BJRI Tosa Pat-8	336.27a	1.42	4.7	3.74a	0.71ab	0.34
Rangpur Famer's field	BJM-10-1-3	368.00a	1.70	3.47	3.10	0.50ab	0.21a
	BJM-10-1-5	369.33a	1.65	3.58	2.94	0.51a	0.21a
	JRO-524	331.00b	1.51	2.7	2	0.40c	0.18b
	BJRI Tosa Pat-8	352.33ab	1.47	2.74	2.52	0.46b	0.21a
Rangpur Substation, BINA	BJM-10-1-3	346.00b	1.66a	3.06b	2.86b	0.52c	0.41a
	BJM-10-1-5	342.33b	1.61ab	3.10b	2.73b	0.43d	0.30b
	JRO-524	357.67ab	1.47b	3.43b	3.16b	0.63b	0.34ab
	BJRI Tosa Pat-8	372.67a	1.60ab	4.30a	4.06a	0.71a	0.35ab
Jamalpur Farmer's Field	BJM-10-1-3	294.67	1.63a	6.6	3.95	0.83	0.38ab
	BJM-10-1-5	275.67	1.61a	6.5	4.03	0.81	0.39b
	JRO-524	297.33	1.53b	5.6	3.53	0.73	0.38ab
	BJRI Tosa Pat-8	287.33	1.58ab	6.7	4.03	0.93	0.4a
BINA Headquarter's, Mymensingh	BJM-10-1-3	241	1.23	3.56	3.2	0.44	0.25c
	BJM-10-1-5	237.33	1.22	3.78	3.53	0.5	0.31a
	JRO-524	250	1.23	4.31	3.6	0.4967	0.26b
	BJRI Tosa Pat-8	251	1.06	3.03	2.86	0.4367	0.22d
Combined Analysis Over location	BJM-10-1-3	316.71	1.54ab	4.39	3.13b	0.65ab	0.33a
	BJM-10-1-5	314.1	1.55a	4.61	3.26a	0.67b	0.33a
	JRO-524	316.43	1.47bc	4.37	3.03c	0.63c	0.32b
	BJRI Tosa Pat-8	321.7	1.46c	4.51	3.34a	0.68a	0.32b
	CV	**3.81**	**4.37**	**10.23**	**5.45**	**6.11**	**7.1**
	Lsd	**13.56**	**0.074**	**0.51**	**0.36**	**0.08**	**0.04**

In a column, values with same letter (s) for individual location/ combined means do not differ significantly at 5% level

Morphological variation of the two advanced lines with the parent JRO-524

Leaf characteristics

Leaf shape of lines BJM-10-1-3 and BJM-10-1-5 are ovate lanceolate whereas in the parent JRO-524, lanceolate shape was found. Leaf length and breadth ratio of two tested lines are 1.30 in contrast in JRo-524 it was about 1.20. There is no variation in leaf texture and leaf margin (Table 4 and Figure 1)

Seed characteristics

In BJM-10-1-3 and BJM-10-1-5 lines, seed coat color is greyish blue and grey but blue seed coat color was found in JRO-524 parent (Table 4). 1000 seed weight of BJM-10-1-3 and BJM-10-1-5 lines are 1.80 and 1.82 gram respectively comparing to parent JRO-524 (1.85 gram).

Table 5. Comparison of BJM-10-1-3 and BJM-10-1-5 with check according to morphological characters

Characteristics	Mutant BJM-10-1-3	Mutant BJM-10-1-5	JRO-524 (parent)
Stem colour	Green	Green	Green
Petiole colour	Green	Green	Green
Stipule Shape	Scaly	Scaly	Scaly
Stipule Colour	Green	Green	Green
Leaf Length-breath ratio	1.30	1.30	1.20
Leaf Shape	Ovate lanceolate	Ovate lanceolate	Lanceolate
Leaf texture	Smooth	Smooth	Smooth
Leaf margin	Wavy	Wavy	Wavy
Pigmentation of flower bud (Calyx)	Green	Green	Green
Days to first flowering	140	139	147
Days to first flowering of 50% plants	140-150	139-150	147-155
Pigmentation of fruits	Green	Green	Green
Seed dispersal mechanism	Indehiscent	Indehiscent	Indehiscent
Seed coat color	Greyish Blue	Gray	Blue
1000 seed weight	1.80 g	1.82 g	1.85 g
Any new Character	Before 15 March sowing there is no effect of early flowering	Before 15 March sowing there is no effect of early flowering	-

Response against disease and insect of mutants and parent

Disease severity for stem rot is higher in BJM-10-1-3 mutant and the parent JR0-524 comparing to the mutant BJM-10-1-5 after artificial inoculation of spore of fungus causing stem rot. Overall, all the lines and parent are highly susceptible to stem rot (Table 5). In natural condition, Jassid insect infestation is higher in the parent JRO-524 parent comparing to the mutants BJM-10-1-3 and BJM-10-1-5 (26% and 30% respectively) while lower yellow mites infestation was observed in the BJM-10-1-5 mutants (13%) comparing to the parent JRO-524 (17%) (Table 6). All the mutants and the parent exhibited moderately tolerance against jassid and yellow mite insect infestation.

Fiber quality of mutants and parent

Fiber content is higher in BJM-10-1-5 mutant (34.04%) comparing to the parent JRO-524 (33.00%) but fiber strength is higher in the parent JRO-524 (2.78) comparing to the mutant BJM-10-1-3 (2.75) and BJM-10-1-3 (2.76).

Table 6. Disease response of 2 mutant lines and parent JRO-524 in artificial condition

Mutant lines with parent	Stem rot of jute		
	Disease Incidence (%)	Disease Reaction	Disease Severity
BJM-10-1-3	92.30	Highly Susceptible	4
BJM-10-1-5	88.87	Highly Susceptible	3
JRO-524	97.72	Highly Susceptible	4

Table 7. Insect and pest response over 2 mutant lines and parent in natural condition

Mutant lines with parent	Jassid insect Infection (%)	Infection Reaction	Yellow mite insect Infection (%)	Infection Reaction
BJM-10-1-3	26%	Moderately Tolerant	16%	Moderately Tolerant
BJM-10-1-5	15%	Moderately Tolerant	13%	Moderately Tolerant
JRO-524	30%	Moderately Tolerant	17%	Moderately Tolerant

Table 8. Comparison of fiber quality of BJM-10-1-3, BJM-10-1-5 and JRO-524

Mutant line with parent	Fiber (%)	Fiber fitness (tex)	Fiber strength (tex)	Brightness (%)
BJM-10-1-3	33.02	2.63	2.75	43.11
BJM-10-1-5	34.04	2.65	2.76	44.15
JRO-524	33.00	2.68	2.78	43.00

DISCUSSIONS

According to Mukul et al. (2020b), the fiber yield content in jute crops depends on its morphological_traits like plant population, plant height, base diameter, fresh weight etc. The maximum fiber yield content is the prime objectives of jute crops (Majumder et al., 2020). The jute variety having higher good quality fiber yield potentiality is the crying need of the farmers for the present situation contributing to the national economy. Plant height and base diameter of jute crops are directly involved with fiber yield. The more plant height and girth or diameter of stem gave higher fiber yield in jute (Mukul et al., 2020b). Significant variation was observed in term of yield and related parameters at Magura comparing with other regions (Table 3). In Magura, Alternate sunshine with rainfall exists that is the crucial factor for getting higher fiber weight. Higher temperature and humidity also contribute fiber and stick yield simultaneously (world jute, 2023). In M_5 generation, significantly higher plant height and base diameter for all the genotypes were found in Magura but comparatively greater yield was found in Rangpur. It is due to its genetic makeup and higher regional adaptability with the climatic condition and soil properties of the experimental field of the present study. These were also found due to its genetic makeup and superior regional stability with the climatic pattern and soil texture of the present study. Maximum difference in varietals performance of *C. olitorius* also indicated the same result (Sanjoy et al., 2018; Hassan et al., 2018). Cellulose, hemicellulose and lignin content are the determiner to obtain high quality jute fiber (Das et al, 2014). Fiber strength is the indicator of exhibiting excellent strength, thermal conductivity, inexpensive and low density. The inhibitory action of tanin influences the fiber fitness of jute. It is evident that, the value of texture of fiber fitness is lower in BJM-10-1-3 and BJM-10-1-5 mutants that are desirable for obtaining good quality fiber and triggers lateral (cross-sectional) swelling of jute fiber in Tossa jute mutants far exceeds its longitudinal swelling greater than 0.4 % improves the fiber strength comparing to the parent.

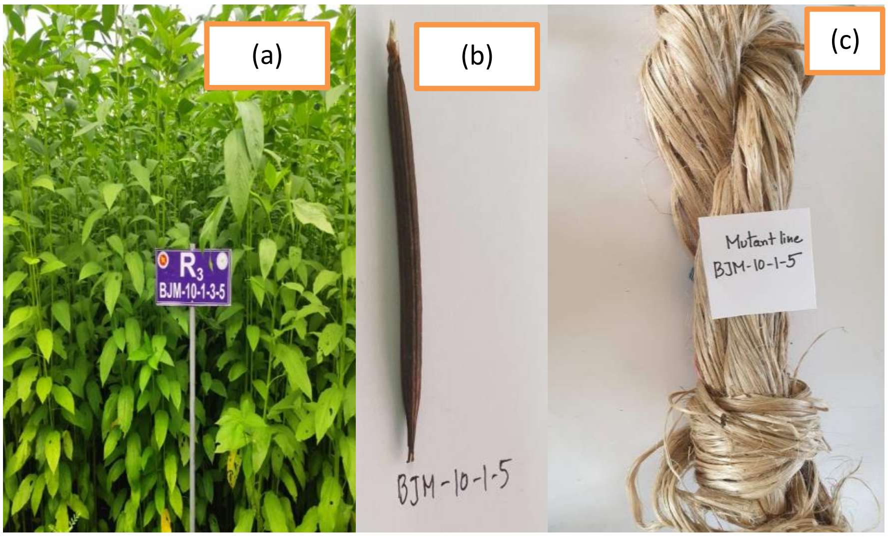

Figure 1. Plate (a) - mutant line BJM-10-1-5 in the field; plate (b)-pod; plate (c)- fiber of that mutant line

CONCLUSION

The mutants BJM-10-1-3 and BJM-10-1-5 performed better in favor of superior fiber yield and earliness. These two lines were applied for variety release

CONFLICT OF INTEREST

The authors declare no conflict of interest to publish the manuscript.

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