

## Evaluation of jute mutants/varieties for resistance to jute hairy caterpillar under field condition

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**Abstract:** Experiment were conducted in the field laboratory to evaluate thirteen mutants of jute namely- CM-80, CM-83, CM-84, CM-86, CM-87, CM-88, CM-89, CM-92, CM-94, CM-96, CM-102, CM-107, CM-78 along with their mother variety D-154 and check variety BINA DESHI PAT-2 for their resistance against major pests of jute, jute hairy caterpillar (*Spilarctia obliqua* Walker) during the period from April to August, 2014. Evaluation was made on the basis of percentage of plants and leaves attacked/ consumed by jute hairy caterpillar. The mutants CM-80, CM-83, CM-84, CM-87, CM-88, CM-89, CM-92, CM-94, CM-96, CM-102, CM-107, CM-78 were found moderately susceptible; CM-86 and the check variety BINA DESHI PAT-2 susceptible; mother variety D-154 highly susceptible to jute hairy caterpillar. Amount of nitrogen in plant/plant parts influenced the infestation of jute hairy caterpillar. A positive correlation was found between the amount of nitrogen in plant and the percentage of leaves infested by jute hairy caterpillar.

**Key words:** Jute hairy caterpillar, thirteen mutants of jute, amount of nitrogen.

### Introduction

Jute is a member of the family Tiliaceae and the genus *Corchorus*. The genus *Corchorus* comprises 40 species out of them two species namely *Corchorus capsularis* L. or deshi jute which originated in India and Myanmar and *Corchorus olitorius* L. or tossa jute which originated in Africa are commercially cultivated for fiber production. Jute constitutes a major tropical fiber crop of considerable economic significance to Bangladesh. Jute fiber is extensively used in the manufacture of different types of packing materials for various agricultural and industrial products. Insect pests along cause about 12% yield loss (Anon, 1987). The jute hairy caterpillar is a poly-phagous insect that causes damage to large number of cultivated as well as non-cultivated plant species (Viswanath and Gowda, 1975). In view of this requirement, the present experiment was undertaken to evaluate several mutant(s)/variety (ies) of jute against jute hairy caterpillar with different objectives. To test the level of resistance of several jute mutants to jute hairy caterpillar of jute under field, laboratory condition, to evaluate the host preference (food consumption) by the larva of *Spilarctia obliqua* and to study the relationship between amount of nitrogen present in jute plants and infestation rate of jute hairy caterpillar.

### Materials and Methods

The experiment was carried out at the Central experiment farm of Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh. The laboratory experiments were also set up at Entomology Division, BINA, Mymensingh. The experimental site is located approximately between the latitudes of 24°26' to 24°54' north and between the latitude of 90°15' to 90°30' East and about 7.9 to 9.1 meter above/over the sea level. The site belongs to the Old Brahmaputra Flood Plain under Agro-Ecological Zone (AEZ) 9. The experimental plots were prepared by proper ploughing and laddering. The land was leveled properly. The seeds were sown after final land preparation at the rate of 6.0-7.5 kg per hectare (Gaffer *et al.*, 1989). Plant to plant spacing was 0.1m and row to row distance was 0.3 m. Sowing was done at a depth 1.25 to 2.5 cm and the seeds were covered with loose soil. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications (Gomez and Gomez, 1984).

Fertilizers were applied once at the time of final land preparation at the rate of 67.5, 25.0 and 30.0 kg Urea, TSP and MOP per hectare respectively. In addition, 5000 kg cowdung per hectare were applied. 37 kg per hectare urea was also applied as top dressing at six weeks after sowing. Test materials- The experimental materials include fifteen jute mutants/varieties belonging to the species *Corchorus capsularis* and their mother varieties CVL-1 and D-154. The mutants/varieties were CM-78, CM-80, CM-83, CM-84, CM-86, CM-87, CM-88, CM-89, CM-92, CM-94, CM-96, CM-102, CM-107, BINA DESHI PAT-2 and D-154. All the mutants were developed from varieties CVL-1 and D-154 through the use of gamma radiation. The adult jute hairy caterpillar insects are medium sized pinkish and buff colored with black spots on the wings. The body is thickly covered with overlapping scales. The head capsule is a simple structure and the mouthparts are greatly reduced. *Spilarctia obliqua* is popularly known as jute hairy caterpillar. It is a poly-phagous insect pest causing damage to a large number of cultivated as well as non-cultivated plant species but severe infestation occurs in jute in the summer season. Inter cultural operations- Necessary intercultural operations were carried out as and when necessary. The plots were exposed to natural infestation and no protective measures were taken against any insect pest. Jute hairy caterpillar data were recorded at 30, 60 and 90 days after sowing (DAS). The total number of infested and un infested plants and leaves were collected from two randomly selected rows of each plot to determine the level of infestation by jute hairy caterpillar. The total number of plants and leaves were counted and percentage of infested plants and leaves by a particular pest species was calculated. The percentage of infestation was calculated by formula.

Percentage of plants or leaves infested =  $(B/A \times 100)$ , where, A = Number of total plants/leaves, B=Number of infested plants or leaves. The damaged plants or leaves were then graded by using the formula (Lateef and Reed, 1983). Per resistance percentage =  $\{(X - Y/X) \times 100\}$ . Where, X = Percentage of infested plants or leaves, Y= Percentage of infested plants or leaves. The pest resistance percentage was then converted to a 1-9 rating (Reed and Lateef, 1980) according to the scale. Amount of jute leaves (dry matter) consumed by jute hairy caterpillar under laboratory condition- The research work was carried out

for assessment of jute mutants for their susceptibility to jute hairy caterpillar. The percentage of dry matter (average) of the jute leaves consumed by the jute hairy caterpillar was calculated by the formula. Percentage of dry matter consumed =  $\frac{\text{Dry matter consumed by caterpillar (g)}}{\text{Average weight of dry matter before feeding (g)}} \times 100$ . Then the mutants were graded as resistant or susceptible.

**Biochemical Analysis of plant:** The plant analyzed for their biochemical constituents, particularly the percentage of nitrogen in them. This was done to correlate the relationship between the amounts of nitrogen present in the plant and the percentage of plants infested by different pests. For this purpose after 60 DAS, top 10 cm of the shoots of 10 plants from each experiment plot was cut and kept separately in polythene bags and brought to the laboratory. The shoots were then dried in the oven at 60°C

for 48 hours. After drying these were ground with a grinding machine and presented in a desiccators for subsequent biochemical analysis. Determination of N% involved 3 steps, Digestion, distillation and titration.

**Data analysis:** Data of different parameters were analyzed statistically. Data obtained from experiments established in the laboratory were analyzed in the computer for one factor Completely Randomized Design (CBD).

## Results and Discussion

**Percentage of infested plants by jute hairy caterpillar at different plant growth stages:** The results of the percentage of infested plants of different mutants/varieties by the jute hairy caterpillar are presented in Table 1.

**Table 1.** Percentage of jute hairy caterpillar infested plants in different mutants/varieties at different days after sowing (DAS)

Mutants/Variety	Percentage of infested plants				Relative resistance/ susceptibility rating
	30 DAS	60 DAS	90 DAS	Mean	
CM-80	26.30 fg	40.36 de	60.00 bc	42.22 d	5
CM-83	27.30 f	37.34 fg	54.95 de	39.86 de	5
CM-84	31.77 d	32.51 i	59.64 bc	41.31 de	5
CM-86	27.34 f	46.69 b	67.72 a	47.25 b	6
CM-87	25.91 gh	40.58 de	53.32 e	39.94 de	5
CM-88	37.64 a	42.33 cd	57.95 cd	45.97 bc	5
CM-89	24.95 b	35.19 gh	58.62 bc	39.59 de	5
CM-92	18.65 j	34.77 hi	67.72 a	40.38 de	5
CM-94	32.10 d	36.00 gh	59.30 bc	42.47 d	5
CM-96	26.68 fg	38.90 ef	48.08 f	37.89 e	4
CM-102	29.13 e	34.58 hi	58.15 cd	40.62 de	5
CM-107	25.82 gh	28.62 j	60.05 bc	38.16 e	4
CM-78	23.23 i	43.27 c	62.27 b	42.92 cd	5
D-154	34.88 b	55.45 a	69.78 a	53.37 a	6
BINA DESHI PAT-2	33.41 c	54.60 a	66.83 a	51.61 a	6
Probability	0.01	0.01	0.01	0.01	
CV (%)	2.55	3.33	3.29	4.44	
LSD	1.211	2.232	3.313	3.186	

\*Mean in a column followed by the same letter (s) is not significantly different at 1% level by DMRT (Duncan's Multiple Range Test)

It is observed from the results that the mutants/varieties had differential response to the attack of jute hairy caterpillar, *Spilarctia oblique* (Walker). At 30 days after sowing (DAS), the highest infestation was observed in the mutant CM-88 (37.64%). The lowest infestation was recorded in the mutant CM-92 (18.65%). The differences between the mutants/ varieties having the highest and lowest infestation were found to be statistically significant. At 60 DAS, the highest infestation was observed in the variety D-154 (55.45%) followed by BINA DESHI PAT-2 (54.60%) and these two varieties were identical statistically. At 90 DAS, the same trend was observed with respect to the infestation of jute mutants/varieties by jute hairy caterpillar. The highest infestation was observed in the variety D-154 (69.78%) which was identical to CM-86 (67.72%) and CM-92 (67.72%) followed by BINA DESHI PAT-2 (66.83%). The highest mean percentage of infestation was found in D-154 (53.37%), which was significantly different from other mutants excepting BINA DESHI PAT-2 (51.61%). The lowest mean percentage of infestation was observed in the mutant CM-96 (37.89%). The resistance/ susceptibility rating of the mutants/varieties were done on the basis of the mean data of three different days after sowing (Table 1). It was observed that twelve mutants, namely CM-80, CM-83, CM-84, CM-87,

CM-88, CM-89, CM-92, CM-94, CM-96, CM-102, CM-107 and CM-78 had lower level of susceptibility than the check variety BINA DESHI PAT-2 which means that these mutants are less susceptible to jute hairy caterpillar. The other two mutants/varieties e.g. CM-86 and D-154 ranked 6. This means that these mutants/varieties have equal level of susceptibility to jute hairy caterpillar in comparison to the check variety. Among the fourteen mutants of jute, none was found to be resistant to jute hairy caterpillar. In all mutants the infestation was lower in early stages (30 DAS) and increased gradually at vegetative stage (60 DAS) and mature stage (90 DAS).

**Percentage of leaves infested by the jute hairy caterpillar at different plant growth stages:** A great deal of variation was observed among different mutants/varieties with respects to the percentage of leaves infested by jute hairy caterpillar in the field (Table 2). The percentage of jute hairy caterpillar infestation varied significantly among the jute mutants/varieties at different plant ages. It was observed that at 30 DAS, the highest percentage of leaf infestation was observed in the mutant CM-88 (22.85%) which was statistically to BINA DESHI PAT-2 (22.12%). At 60 DAS, the highest percentage of leaf infestation was recorded in the variety D-154 (40.55%) which was statistically identical to BINA DESHI

PAT-2 (39.90%). At 90 DAS, the maximum leaf infestation was recorded in D-154 (49.14%) which statistically different from all other mutants/variety and the minimum

leaf infestation was observed in CM-84 (35.89%), CM-96 (36.35%) and CM-87 (37.43%).

**Table 2.** Percentage of jute hairy caterpillar infested leaves in different mutants/varieties at different days after sowing (DAS)

Mutants/Variety	Percentage of infested leaves			Mean	Relative resistance/susceptibility rating
	30 DAS	60 DAS	90 DAS		
CM-80	20.79 b	35.52 bc	38.64 ef	31.65 bcd	5
CM-83	16.70 d	26.26 h	39.46 de	27.47 de	5
CM-84	17.28 d	28.91 g	35.89 g	27.36 de	5
CM-86	20.15 b	37.27 b	44.12 b	33.85 abc	6
CM-87	16.41 d	27.94 gh	37.43 fg	27.26 de	5
CM-88	22.85 a	29.57 fg	40.92 cd	31.11 bcd	5
CM-89	16.27 de	32.45 de	42.36 c	30.36 cd	5
CM-92	17.27 d	34.03 cd	43.93 b	31.74 bcd	5
CM-94	16.73 d	30.91 ef	39.63 de	29.09 de	5
CM-96	15.04 e	24.94 i	36.35 g	25.44 e	4
CM-102	18.86 c	33.85 cd	40.85 cd	31.19 bcd	5
CM-107	16.87 d	31.97 e	45.46 b	31.43 bcd	5
CM-78	17.61 d	35.87 b	42.09 c	31.86 bcd	5
D-154	20.64 b	40.55 a	49.14 a	36.78 a	6
BINA DESHI PAT-2	22.12 a	39.90 a	45.13 b	35.72 ab	6
Probability	0.01	0.01	0.01	0.01	
CV (%)	4.01	3.14	2.17	7.89	
LSD	1.232	1.719	1.505	4.066	

\*Mean in a column followed by the same letter (s) is not significantly different at 1% level by DMRT (Duncan's Multiple Range Test)

On an average, the leaf infestation was highest in the susceptible variety D-154 (36.78%) and lowest infestation CM-96 (25.44%). It can be seen that the mutants CM-96 ranked 4 and the mutants CM-80, CM-83, CM-84, CM-87, CM-88, CM-89, CM-92, CM-94, CM-102, CM-107 and CM-78. This means that these mutants have lower level of susceptibility to jute hairy caterpillar than the check variety BINA DESHI PAT-2 and D-154 in other words;

these mutants have some degree of tolerance to jute hairy caterpillar in comparison to the check variety. The rest of the mutants/varieties ranked 6. This means that these mutants have equal level of susceptibility to jute hairy caterpillar as the check variety. In the mutant CM-96, the infestation was lower in the early stage (30DAS) and increased gradually during their growth period (60 DAS) and mature stage (90 DAS).

**Table 3.** Percentage of jute leaves (dry matter) consumed by jute hairy caterpillar

Mutants	Average amount of dry matter jute leaves consumed (%)	Relative resistance/susceptibility rating
CM-80	34.09 de	5
CM-83	20.83 i	4
CM-84	32.55 ef	5
CM-86	43.58 b	6
CM-87	21.27 i	4
CM-88	25.00 h	4
CM-89	25.41 h	4
CM-92	25.08 h	4
CM-94	29.26 g	4
CM-96	18.75 i	3
CM-102	30.95 fg	5
CM-107	30.43 fg	5
CM-78	36.58 d	6
D-154	54.05 a	8
BINA DESHI PAT-2	40.00 c	6
Probability	0.01	
CV (%)	5.67	
LSD	2.946	

\*Mean in a column followed by the same letter (s) are not significantly different at 1% level by DMRT (Duncan's Multiple Range Test)

**Amount of jute leaves (dry matter) of each mutant/variety consumed by jute hairy caterpillar under laboratory condition:** The amount of dry matter of jute leaves of different mutants/varieties consumed by jute hairy caterpillar is presented in Table 3. It was observed that the caterpillar responded differently to different mutants/varieties with respect to the consumption of leaves. The percentage of dry matter consumption of different mutants/varieties ranged from 18.75 (CM-96) to 54.05 (D-154). The jute hairy caterpillar consumed the highest percentage of dry matter in the variety D-154

(54.05%), which was significantly different from other mutants/varieties and the lowest consumption was found in CM-96 (18.75%), which was statistically similar to the mutants/varieties CM-83 (20.83%) and CM-87 (21.27%). The percentage of leaf consumption by jute hairy caterpillar varied significantly ( $P < 0.01$ ) among different mutants/varieties. Resistance/susceptibility rating of the mutants/varieties was also done depending on the amount of dry jute leaves consumption. The mutant CM-96 had the ranking of 3 and the mutants CM-83, CM-87, CM-88, CM-89, CM-92 and CM-94 had the ranking of 4 and also

the mutants CM-80, CM-84, CM-102 and CM-107 had ranking of 5. So, it can be said that these eleven mutants are less susceptible to jute hairy caterpillar than the check varieties BINA DESHI PAT-2 and D-154. The mutant BINA DESHI PAT-2, CM-78, CM-86 had the ranking of 6 and D-154 had the ranking of 8.

It is revealed from the results of previous three experiments that the gamma radiation has changed the genetic makeup of the mutants and has created variability evolving mutants these responded differently to jute hairy caterpillar, a serious pest of jute in Bangladesh. The mutants/varieties can be grouped into different categories depending on the ranked value of the three experiments described previously. The categories are shown in Table 4. Here, the rating value observed was taken for designating each mutant into different categories. Similar findings were observed by Husain and Begum (1995) that the variety D-154 was highly susceptible to *Spilarctia obliqua* Walker.

**Table 4.** Reaction of different mutants/varieties to jute hairy caterpillar

Mutants/Varieties	Resistance/susceptibility rating	Reaction
CM-96	4	Moderately susceptible
CM-80, CM-83, CM-84, CM-87, CM-88, CM-89, CM-92, CM-94, CM-102, CM-107, CM-78	5	Moderately susceptible
CM-86, BINA DESHI PAT-2	6	Susceptible
D-154	7	Highly susceptible

**Amount of nitrogen present in different mutants of jute plants:**

The amount of nitrogen varied significantly among different mutants and ranked from 2.16% to 2.71% (Table 5). The highest percentage of nitrogen was found in the mutants CM-86 (2.71) which was significantly different from the other mutants. The lowest percentage of nitrogen was observed in the mutant CM-96 (2.16), which was significantly different from the other mutants.

In present study results showed that variety D-154 was highly infested by jute hairy caterpillar in the field and had highest mean percentage of plant and leaf infestation. Within thirteen mutants CM-86 was highly infested by jute hairy caterpillar. The lowest percentage of infested leaves and plants were observed in the mutants CM-96. The mutant CM-96 was also less infested by jute hairy

caterpillar. Considering all the field and laboratory data, the mutants were rated on the basis of relative resistance/susceptibility rating. The mutants CM-86, BINA DESHI PAT-2 were graded as susceptible, the variety D-154 highly susceptible and rest of the mutants moderately susceptible to jute hairy caterpillar.

**Table 5.** Total nitrogen content of shoots of different mutants/varieties of jute

Mutants/Varieties	Nitrogen percentage
CM-80	2.53 e
CM-83	2.41 j
CM-84	2.29 l
CM-86	2.71 a
CM-87	2.24 m
CM-88	2.42 i
CM-89	2.39 k
CM-92	2.57 d
CM-94	2.44 g
CM-96	2.16 n
CM-102	2.41 j
CM-107	2.43 h
CM-78	2.52 f
D-154	2.70 b
BINA DESHI PAT-2	2.65 c

\* Means in a column followed by the same letter (s) are not significantly different at 1% level by DMRT (Duncan's Multiple Range Test).

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