SCREENING OF MUTANTS OF JUTE FOR RESISTANCE TO JUTE STEM WEEVIL

M. M. H. BHUYAIN[1], M.N.UDDIN[1], M. SHAHJAHAN[2] M. HUSAIN[3] AND R. ARA[4]

[1]Lecturer, [2]Professor, Department of Entomology, Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh-2202, [3] Chief Scientific Officer (CSO), Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh-2200, [4]Associate Professor, Department of Entomology, Hajee Mohammad Danesh Science & Technology University (HSTU), Dinajpur – 5200

Accepted for publication: April 12, 2008

ABSTRACT

Bhuyain M. M. H., Uddin M.N., Shahjahan M., Husain M. and Ara R. 2008. *Screening of Mutants of Jute for Resistance to Jute Stem Weevil.* **Int. J. Sustain. Crop Prod. 3(3):55-60**

An experiment was conducted the central experimental farm of Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh during the period from March to August, 2003 to evaluate resistance of fourteen mutants of jute (*Corchorus capsularis)* against jute stem weevil, *Apion corchori* Marshall along with the check variety BlNADESHlPAT-2 in the field of Bangladesh Institute of Nuclear Agriculture (BINA). Assessments were made on the basis of percentage of plants and leaves infested by jute stem weevil. All of the tested mutants/varieties were found as moderately resistant to jute stem weevil.

Key words: Screening, *Corchorus capsularis*, *Apion corchori* (Marshall), mutants, resistant.

INTRODUCTION

Jute is important cash-cum fibre crop in Bangladesh. It plays a vital role in our national economic development. About 3588.12 million US dollar was earned by exporting raw jute and 68.78 million US dollar was earned by exporting jute goods in 1999-2000 (Anonymous, 2000). So, jute is the golden fibre of Bangladesh is rightly so called as it earns lion's share of the foreign exchange. But about 12% yield loss of jute is caused by the attack of insect pest alone (Anonymous, 1987). Among the jute pests *Apion corchori* Marshall popularly known as jute apion or jute stem weevil (Maxwell-Lefroy, 1909) is also a very destructive pest of jute in Bangladesh. It attacks the jute plants at all stages of their growth (Ghosh *et al.*, 1917). This pest is found in jute growing season from mid April to July and attacks both the cultivated species of jute e.g. *Corchorus capsularis* and *Corchorus olitorius.* 'Bon okra' is an alternative host of this pest (Das, 1944). The injury is mainly caused by the feeding of grubs. They cause damage by forming knots both on the jute fibres and sticks, which creates a very serious problem for their quality processing in the jute industry. As a result, the fibre continuity is disrupted and black holes are seen in the jute sticks (Kabir, 1966a). These lower quality of fibre for industrial use and hence reduce their market value. Various control methods namely, cultural, mechanical, biological and chemical are used to control jute pests but none of them provides effective control. It is also a fact that the farmers have to depend upon synthetic insecticides for the control of this pest. But due to nonjudicious and repeated use of chemical insecticides, the pest has developed resistance to many recommended insecticides. Attempts were made to screen several jute mutants for resistance to jute stem weevil, *Apion corchori* to minimize the use of insecticides and thereby reducing the deleterious side effects of pesticides and environmental pollution. Hence, the research programme was undertaken to screen out resistant of jute mutants against jute stem weevil.

MATERIALS AND METHODS

Field trials

Field trials were carried out at the central experimental farm of Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh during the period from March to August, 2003 (Kharif season). Fourteen promising jute mutants developed at BINA namely CM-84, CM-77, CM74, CM-81, CM-70, CM-102, CM-66, CM-72, CM-96, C-26, CM-87, C-443, CM-101 and CM-63 were screened against jute stem weevil. In addition, to test the entries BlNADESHlPAT-2 was used as the susceptible check variety. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The size of the individual plot was 4 m x 1 m. The spacing between two plots and lines was 0.4 m and 0.3 m, respectively. The seeds were sown in a well prepared land. All the agronomic practices were adopted in raising the crop. Infestations of jute plants under field condition by jute stem weevil were recorded at different period of plant growth starting from 60 days after sowing (DAS) to 120 DAS. The total number of infested and uninfested plants and leaves were collected from two randomly selected rows of each plot to determine the level of infestation. The total number of plants and leaves were counted and percentage of infested plants and leaves by a particular pest species was calculated. The damaged plants or leaves were then graded by using the following formula (Lateef and Reed, 1983) which was originally used for grading chick pea.

$$\text{Pest resistance percentage (\%)} = \frac{X-Y}{X} \times 100$$

Where,

X = Percentage of infested plants or leaves in check
Y = Percentage of infested plants or leaves in test

The pest resistance percentage was then converted to a 1-9 rating (Lateef and Reed, 1983) according to the following scale:

Plant resistance percentage	Rating scale	Relative resistance / susceptibility
100%	1	Increasing resistance ↑
75 to 99%	2	
50 to 75%	3	
25 to 50%	4	
10 to 25%	5	
-10 to 10%	6	Equal to check
-25 to -10%	7	
-50 to -25%	8	↓
-50 to less	9	Increasing susceptibility

RESULTS AND DISCUSSION

Percentage of plants infested by jute stem weevil at different stages of plant growth

The tested mutants/varieties of deshi jute were infested by jute stem weevil and the percentage of infestation at different plant growth stages is presented in Table 1. The mutants had significant variation in the level of attack by jute stem weevil at different growth stages. It was observed from the results that the percentage of jute stem weevil infestation ranged from 46.67 (CM-63, CM-74 and CM-70) to 86.67 (C-443) at 60 DAS, 60.00 (C-26) to 100.00 (CM-96) to at 90 DAS and 73.33 (C-26, CM-81, C-443) to 93.33 (CM-77, CM-72, CM-63 and BINADESHIPAT-2) at 120 DAS.

Table 1. Percentage of plants of different mutants/varieties infested by jute stem weevil

Mutants/Varieties	Percentages of infested plants				Relative resistance / susceptibility rating
	60 DAS	90 DAS	120 DAS	Mean	
CM-84	58.33 c	80.00 d	80.00 bc	72.78 de	5
CM-77	60.00 c	73.33 e	93.33 a	75.55 cd	6
CM-74	46.67 d	80.00 d	80.00 bc	68.89 fg	5
CM-81	66.67 b	73.33 e	73.33 c	71.11 ef	5
CM-70	46.67 d	66.67 f	86.67 ab	66.67 gh	5
CM-102	66.07 b	80.00 d	86.67 ab	77.58 bc	6
CM-66	60.00 c	93.33 b	80.00 bc	77.77 bc	6
CM-72	66.67 b	73.33 e	93.33 a	77.77 bc	6
CM-96	60.00 c	100.00 a	86.67 ab	82.22 a	6
C-26	60.00 c	60.00 g	73.33 c	64.44 h	5
CM-87	66.67 b	86.67 c	86.67 ab	80.00 ab	6
C-443	86.67 a	66.67 f	73.33 c	75.55 cd	6
CM-101	66.67 b	86.67 c	86.67 ab	80.00 ab	6
CM-63	46.67 d	93.33 b	93.33 a	77.77 bc	6
BINADESHIPAT-2	66.67 b	86.67 c	93.33 a	82.22 a	6
Probability	0.01	0.01	0.01	0.01	
CV (%)	4.71	4.26	4.78	6.58	
Lsd $_{0.05}$	4.85	5.70	6.75	2.70	

Means in a column followed by the same letter (s) are not significantly different at 1% level by DMRT, DAS = Days after sowing

At 60 DAS, the lowest jute stem weevil infestation was observed in the mutants CM-63 (46.67%), CM-74 (46.67%) and CM-70 (46.67%) followed by the mutants CM-84 (58.33%),CM-77 (60.00%), CM-66 (60.00%), CM-96 (60.00%), C-26 (60.00%).The highest infestation was recorded in the mutant C-443 (86.67%), which was significantly different from the rest of the mutants/varieties. At 90 DAS, the lowest infestation was recorded in the mutant C-26 (60.00%), which was statistically different from the other mutants/varieties and the highest infestation was recorded in the mutant CM-96 (100.00%). At 120 DAS, range of infestation varied between 73.33 to 93.33%. The lowest infestation was observed in the mutant C-26, CM-81and C-443 and these were followed by the mutants CM-84, CM-66 and CM-74. The highest infestation was found in the check variety BINADESHIPAT-2 (93.33%), which was significantly different from CM-84, CM-74, CM-81, CM-66, C-26, and C-443 and statistically identical to the rest of the mutants. From the mean of three samples, the lowest infestation was also observed in the mutant C-26 (64.44%), which was statistically different from the other mutants except in the mutant CM-70 (66.67%). The highest infestation was found in mutant CM-96 (82.22%) and the check variety BINADESHIPAT-2 (82.22%), which was significantly different from the other mutants except in the mutants CM-87 (80.00%) and CM-101 (80.00%). Both of them are statistically identical.

On an average, the mutants CM-84, CM-74, CM-81, CM-70 and C-26 having rank 5 were found to be less susceptible to jute stem weevil than the check variety BINADESHIPAT-2. The other mutants were susceptible to jute stem weevil because they were statistically at the same level with respect to resistance/susceptibility rating (ranked 6). The infestation of jute stem weevil was observed to increase gradually with the progress of time. This is because the population of weevils increased gradually in the later part of the season. The cause of such increase is due to the fact that the weevils complete their life cycle within 20-24 days. The adults have a pretty long life (around 206 days) and the female had a prolonged ovipositional period of about 124 days (Hazarika, 1952) which lays about 624 eggs throughout the life time.

Number of knots per plant

The numbers of knots per plant of selected jute mutants at different plant growth stages are presented in the Table 2. The mutants were graded following the means of data recorded at 60 DAS, 90 DAS and 120 DAS. The highest number of knots was found in the mutant BINADESHIPAT-2 (3.27), which was significantly different from the other mutants. The lowest infestation was observed in C-26 (1.58), which was significantly different from the other mutants/varieties. Here, it is shown that in all of the mutants had less than 4.00 knots; this means that these are moderately resistant (Table 3) to jute stem weevil. The mutants having less than 4 knots per plant are designated as moderately resistant to jute stem weevil (Miah 1980; Husain *et al.*, 1991).

Table 2. Number of knots found in different mutants/varieties formed due to jute stem weevil infestation

Mutants/Varieties	Number of knots per plant			
	60 DAS	90 DAS	120 DAS	Mean
CM-84	1.67 cde	2.07 de	1.80 efg	1.85 cde
CM-77	1.33 fg	2.27 cd	2.13 def	1.91 cde
CM-74	1.93 c	1.80 ef	2.87 b	2.20 bcd
CM-81	1.93 c	2.27 cd	1.80 efg	2.00 bcde
CM-70	1.60 ef	2.60 b	2.13 def	2.11 bcd
CM-102	1.87 cdf	2.27 cd	2.87 ab	2.34 bc
CM-66	1.87 cdf	2.80 b	2.20 de	2.29 bcd
CM-72	1.60 def	2.23 cd	2.13 def	1.99 bcde
CM-96	1.87 cde	2.53 bc	2.73 bc	2.38 bc
C-26	1.13 g	1.87 ef	1.73 fg	1.58 e
CM-87	1.90 cd	1.67 f	2.40 cd	1.99 bcde
C-443	1.90 cd	1.80 ef	1.60 g	1.77 de
CM-101	1.83 cde	2.50 bc	2.00 defg	2.11 bcd
CM-63	2.47 b	2.60 b	2.33 cd	2.47 b
BINADESHIPAT-2	2.80 a	3.73 a	3.27 a	3.27 a
Probability	0.01	0.01	0.01	0.01
CV (%)	8.39	7.38	10.45	12.70
Lsd $_{0.05}$	0.26	0.29	0.40	0.46

Means in a column followed by the same letter (s) are not significantly different at 1% level by DMRT, DAS = Days after sowing

Table 3. Reaction of jute mutants against jute stem weevil

Mutants/Varieties	Reaction
CM-84, CM-77, CM-74, CM-81, CM-70, CM-102, CM-66, CM-72, CM-96, C-26, CM-87, C-443, CM-101, CM-63 and BINADESHIPAT-2	Moderately resistant

Number of knots at different heights of the plant:

The data on the number of knots at different heights of the plants are presented in Table 4. It is observed from the results that with a few exceptions, maximum number of knots were present in the heights ranging between 31.0 to 120.0 cm. In all of the mutants except C-443, the highest number of knots was found at the heights of 31.0-60.0 and 61.0-90.0 cm. Statistically significant differences were observed among different plant heights of all individual mutants. Among different mutants, no significant differences was observed in the level of attack at the heights of 1-30, 31-60, 61-90 cm. So, it is obvious from the results that the weevils prefer to infest the jute plants at the heights from 31-120 cm.

Table 4. Number of knots found in different heights of jute mutants/varieties formed due to jute stem weevil infestation

Mutants/Varieties	Average number of knots per plant at different height(cm)							
	1-30 cm	31-60 cm	61-90 cm	91-120 cm	121-150 cm	151-180 cm	181-above	Probability
CM-84	0.33 E	3.33 A	2.33 B	1.67 cdef C	1.67 abc D	1.67 abc D	0.00 b F	0.01
	(0.85)	(1.95)	(1.68)	(1.44)	(1.25)	(1.25)	(0.71)	
CM-77	0.67 C	3.00 A	1.67 B	2.33 abc A	1.67 abc B	1.33 abc B	1.33 a B	0.01
	(1.05)	(1.81)	(1.25)	(1.68)	(1.44)	(1.34)	(1.34)	
CM-74	0.00 F	4.33 A	2.67 C	3.33 a B	1.67 abc D	1.67 ab D	0.67 ab E	0.01
	(0.71)	(2.15)	(1.64)	(1.95)	(1.44)	(1.44)	(1.05)	
CM-81	1.00 C	2.00 A	2.00 A	2.00 bcde A	1.33 cd B	1.33 abc B	0.33 ab D	0.01
	(1.17)	(1.58)	(1.58)	(1.58)	(1.29)	(1.29)	(0.85)	
CM-70	1.00 C	2.00 B	2.00 B	2.33 abc A	1.00 cd C	0.67 abc D	0.33 ab E	0.01
	(1.17)	(1.58)	(1.58)	(1.68)	(1.17)	(1.05)	(0.85)	
CM-102	1.33 E	2.00 CD	3.00 AB	2.67 ab BC	2.00 abc CD	2.67 a A	2.00 a DE	0.01
	(1.34)	(1.58)	(1.81)	(1.71)	(1.58)	(1.86)	(1.47)	
CM-66	1.00 B	2.33 A	2.00 A	1.33 def B	2.33 a A	1.00 abc B	0.33 ab C	0.01
	(1.17)	(1.68)	(1.58)	(1.34)	(1.68)	(1.17)	(0.85)	
CM-72	0.67 D	2.67 A	1.00 C	1.00 fg C	2.33 ab A	1.67 abc C	2.00 a B	0.01
	(1.05)	(1.64)	(1.22)	(1.22)	(1.68)	(1.25)	(1.47)	
CM-96	2.00 C	3.67 A	1.00 D	2.33 abc B	1.67 abc D	1.67 abc D	1.33 ab CD	0.01
	(1.47)	(2.05)	(1.17)	(1.68)	(1.25)	(1.25)	(1.29)	
C-26	0.00 F	1.00 DE	2.33 A	1.33 efg CD	1.67 abc AB	1.33 abc BC	0.67 ab E	0.01
	0.71)	(1.17)	(1.54)	(1.29)	(1.44)	(1.34)	(1.05)	
CM-87	0.67 D	2.67 A	2.67 A	1.67 bcdef B	1.00 cd CD	2.00 ab B	1.67 ab C	0.01
	(1.05)	(1.71)	(1.71)	(1.47)	(1.17)	(1.47)	(1.25)	
C-443	0.00 D	1.33 B	1.33 B	1.33 def B	2.00 abc A	0.33 bc C	0.33 ab C	0.01
	(0.71)	(1.29)	(1.29)	(1.34)	(1.58)	(0.58)	(0.85)	
CM-101	1.33 BC	1.00 DE	2.00 A	0.67 gh E	1.00 bcd CD	1.67 ab AB	2.00 ab AB	0.01
	(1.34)	(1.17)	(1.58)	(1.05)	(1.22)	(1.44)	(1.47)	
CM-63	1.33 B	3.33 A	4.00 A	0.33 h C	0.33 d C	0.00 c D	0.33 ab C	0.01
	(1.29)	(1.95)	(2.06)	(0.85)	(0.85)	(0.71)	(0.85)	
BINADESHIPAT-2	3.00 A	1.00 B	3.00 A	2.00 abcd A	1.33 bc B	1.33 abc B	1.67 a B	0.01
	(1.68)	(1.22)	(1.68)	(1.58)	(1.34)	(1.29)	(1.25)	
Probability	NS	NS	NS	0.05	0.05	0.05	0.05	
CV (%)	-	-	-	12.83	18.90	17.14	12.70	
Lsd $_{0.05}$	-	-	-	0.24	0.38	0.59	0.53	

Means in a column and row followed by the same letter (s) are not significantly different at 1% and 5% level by DMRT

Figures within parentheses are square root transformation (RSQ)

NS = Non significant

REFERENCES

Anonymous, 2000. About 25 percent export has increased during the first three months but decreased the export of raw jute. The Daily Ittefaq. Monday, 20th November, 2000. 9 p

Anonymous, 1987. Technological advancement in jute cultivation. 1st edition. Bangladesh Jute Research Institute (BJRI), Dhaka. 36 p

Das, G.M. 1944. Studies on the jute stem weevil *Apion corchori* Marshall. Indian J. Agril. Sci. 14: 295-303

Ghosh, H., Dutta, L. and Fletcher, T.B. 1917. Rept. Proc. 2nd Ent. Meet. Pusa. 134 p

Hazarika, S.H. 1952. Destructive insects of Eastern Pakistan and their control. East Bengal Govt. Printing Press, Dhaka. 98 p

Husain, M., Begum, M., Begum, N. and Haque, M.R. 1991. Jute mutants and their level of susceptibility of jute stem weevil, *Apion corchori* Marshall. Bangladesh J. Agril. Sci. 18 (2): 195-197

Kabir, A.K.M.F. 1966a. Phase variation in the jute hairy caterpillar, *Diacrisia obliqua* Walker (Lepidoptera: Arctiidae). Sind. Univ. Sci. J. 11: 1-3

Lateef, S. S. and Reed, W. 1983. Grading plant genotypes for their resistance to insect pest in a field-screening programme. P.8. Presented at National Seminar on Breeding Crop Plants for Resistance to Pest and Diseases.TNAU, Coimbatore, 25-27, May, 1983

Maxwell-Lefroy, H. 1909. Hairy caterpillar pests of crops. Agril. J. Indian. 1(1): 187-191

Miah, M.A.H. 1980. Studies on susceptibility of several jute mutants to jute stem weevil, *Apion corchori* Marshall. Bangladesh J. Agril. Sci. 7(1): 75-79