

Project ID -785

Competitive Research Grant

Sub-Project Completion Report

On

**Study on bionomics, Species diversity/host range,
management technique of mealy bug in kenaf
and mesta**

Project Duration

May 2017 to September 2018

Entomology Department
Bangladesh Jute Research Institute
Manik Mia Avenue, Dhaka 1207



Submitted to
Project Implementation Unit-BARC, NATP-2
Bangladesh Agricultural Research Council
Farmgate, Dhaka-1215



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Project Implementation Unit

National Agricultural Technology Program-Phase II Project (NATP-2)

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Acronyms

PCR	: Project Completion Report
NATP	: National Agricultural Technology Program
PIU	: Project Implementation Unit
BARC	: Bangladesh Agriculture Research Council
BJRI	: Bangladesh Jute Research Institute
RCBD	: Randomized Complete Block Design
CRD	: Complete Block Design
SP	: Soluble Powder
EC	: Emulsifiable Concentrate
Kg	: Kilogram
Ha	: Hectare
L	: Liter
ml	: milligram
JAES	: Jute Agriculture Experimental Station
T	: Twig
L	: Leaf
B	: Base
m	: meter
SD	: Standard Deviation
SE	: Standard Error
LSD	: Least Significant Different
CV	: Coefficient of Variance

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Executive Summary

Mealy bug is one of the most destructive pest of kenaf and Mesta in Bangladesh. It has recently been causing considerable economic concern in the production of other crops such as papaya, mango, jackfruit etc. Survey programs were conducted at Chandina, Cumilla; Regional Station, Rangpur; Regional Station, Kishoreganj; Sub-Station, Monirampur, Jashore; Sub-Station, Patuakhali and Sub-Station, Tarabo, Narayanganj and Farmers fields of kenaf and Mesta at Tangail, Jamalpur and Kishoreganj during growing season from July, 2017. The highest infestation of Mealy bug (81%) was found in HC-95 of kenaf variety at Narayanganj sub-station of BJRI. Most infested part of plant was twig. No Mealybug infestation was found in Dhonbari and Gopalpur of Tangail region. On the other hand, in Cumilla and Faridpur Mealybug infestation was found in jute plant especially in O-9897 and O-795 variety.

The specimens of Mealy bug were collected from naturally infested plant of kenaf and Mesta for identification and sorting. Mealybugs are being reared in laboratory after collection of Mealybug from kenaf and Mesta plant using host plant or food materials. The life cycle of Mealybug was 35-37 days. Mean developmental periods of 1st, 2nd, 3rd instars and adult were 3.57 ± 0.534 , 7.14 ± 1.069 , 7.71 ± 0.755 and 16 ± 1.414 days, respectively. Host diversity and host preference of Mealybug on different plant growing on pot are being observed with nymphs and adults of Mealybug in a controlled environment. Alternate host of Mealybug of kenaf and Mesta were found in potato, tomato, brinjal and guava but none of Mealybug were found in papaya and chilli. Mealybug was reared on sprouting potato and pumpkin (sweet gourd). Field experiments were carried out in the field of Rangpur regional station and Patuakhali sub-station to quantify the yield loss of kenaf and Mesta caused by Mealybug along with varietal assessment during June to November, 2017 using a RCBD design with 3 replications. HC-95, HC-2, BJRI Kenaf-3 (Bot kenaf) and HS-24 variety were grown in the field. BJRI Kenaf-3 (Bot kenaf) showed the highest level of mealy bug infestation (73.59%) causing 34.26% fibre yield loss at Rangpur regional station but at Patuakhali sub-station infestation was 47.98% causing 32.73% fibre yield loss. At pot experiment Seven insecticides such as Sevin 85SP, Nitro 505EC, Ecomecs, Bioneem plus, Neem seed kernel extract, Phyto kill, Detergent powder+ Sevin 85SP @ 1.7 kg/ha, 1 L/ha, 500 ml/ha, 1 L/ha, 1: 10, 2.5L/ha, 1.7 kg/ha, respectively were sprayed after 60 days of sowing for controlling Mealybug.

These insecticides were found most effective against Mealy bugs giving 92.60, 88.64, 84.56, 78.40, 74.40, 92.40 and 95.60 % mortality of Mealybug over control plot, respectively. The highest percent mortality of Mealybug (95.60%) was found from the plot treated with Detergent Powder+ Sevin 85 SP. In field experiment, seven insecticides such as Sevin 85SP, Nitro 505EC, Ecomecs, Bioneem plus, Neem seed kernel extract, Phyto kill, Detergent powder+ Sevin 85SP @ 1.7 kg/ha, 1 L/ha, 500 ml/ha, 1 L/ha, 1: 10, 2.5L/ha, 1.7 kg/ha, respectively were sprayed after 60 days of sowing for controlling Mealy bugs at Jute Agriculture experimental Station, Manikganj. All were found most effective against Mealybug giving 87.37, 83.49, 80.47, 80.57, 71.27, 92.27, 91.45, and 92.77% reduction of infestation over control plot, respectively. The highest percent reduction of Mealybug infestation (92.77%) was found from the plot treated Detergent Powder + Sevin 85 SP, which was statistically similar with phytokill but different from others.

RG Sub-Project Completion Report (PCR)

A. Sub-project Description

1. Title of the CRG sub-project: : Study on bionomics, Species diversity/host range, management technique of Mealybug in kenaf and mesta

2. Implementing organization: Entomology Department Bangladesh Jute Research Institute Manik Mia Avenue, Dhaka 1207

3. Name and full address with phone, cell and E-mail of PI: Dr. Md. Nazrul Islam

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4 Sub-project budget (Tk): Total: 1433995.00

5. Duration of the sub-project:

Start date (based on LoA signed): May 2017

End date: September 2018

6. Justification of undertaking the sub-project:

Kenaf (*Hibiscus cannabinus* L.) and Mesta (*H. sabdariffa* L.) are the most promising soft bast fibre of the jute substitute belongs to Malvaceae family which are economically important as a source of food, beverage, fibre, medicines and some other species as ornamentals (Bolade *et al.*, 2009).

Kenaf is a commercially important fibre crop next to cotton and jute. Both jute and kenaf constitute raw jute as it goes in trade and industry. Kenaf accounts for about 10 percent of total raw jute production in Bangladesh (Deb and Bairagi, 2008). In Bangladesh, around 0.04 million hectares of land is now devoted to kenaf cultivation producing 0.08 – 0.09 million tons per annum with an average yields of 2.0 - 2.5 tons/ha (Mostofa, 2012). Kenaf and Mesta

cultivation is increasing day by day, especially Kishoreganj, Cumilla, Jashore, Sirajganj and Jamalpur regions.

Mealybug (*Pseudococcus virgatus* Ckll.) belongs to Hemiptera: Pseudococcidae is one of the most destructive pest of kenaf and mesta in Bangladesh. It has recently been causing considerable economic concern in the production of other crops such as papaya, mango, jackfruit etc. These are small size, polyphagous, soft bodied, waxy covering and sap sucking pests. These insects inflict direct damage to crops by feeding and some species act as vectors in transmission of plant diseases.

Mealybug feeds on phloem, tissues attacks the growing points and young twigs of plants and injects salivary toxins, which cause characteristic distortion of stems, leaves and fruits, curling of leaf and shorten internodes resulting resettling or “bunchy top” (Williams, 1996). Heavily infested leaves, flowers and fruits often abscise prematurely if infestation is not eliminated. Additional damage may be caused by sooty mold growing on the secreted honeydew, reducing photosynthesis and affecting market value. The information on diversity and status of Mealy bug are scarce in respect of Bangladeshi conditions.

Sub-project goal: To develop sustainable management technique against Mealybug in kenaf and Mesta

Sub-project objective (s):

1. To study the biology, and host diversity of mealy bug
2. To quantify the yield loss caused due to mealy bug infestation
3. To develop a suitable management package against mealy bug

Implementing location (s): Laboratory Entomology Department, BJRI, Central Staten, Dhaka Rangpur regional station, JAES, Manikganj and Patuakhali sub-station.

7. Methodology in brief:

Experiment 1: Survey and collection of samples of mealybug from different places

During first Half year i.e. from June, 2017 to November, 2017 Survey programs were conducted at Chandina, Cumilla; regional Station, Rangpur; regional Station, Kishoreganj; Sub-Station, Monirampur, Jashore; Sub-Station, Patuakhali and Sub-Station, Tarabo, Narayanganj and Farmers field of kenaf and mesta at Tangail, Jamalpur and Kishoreganj from time to time to get idea about the incidence of Mealybug. Collected specimens of Mealybug were brought to laboratory at Entomology Department, BJRI for identification and sorting.

Experiment 2: Development of rearing technique of Mealybug

The specimens of Mealy bug were collected from naturally infested plant of kenaf and Mesta for identification and sorting. Mealy bugs were placed on rearing materials like sprouting potato, pumpkin for rearing which were kept in plastic pot at Entomology Department Laboratory, BJRI.

Experiment 3: Study on host range Mealybug of kenaf and Mesta

Different host plants like papaya, tomato, chilli, brinjal, guava and potato were grown in earthen pots on the roof of Department of Entomology, BJRI following Randomized Complete Block Design (RCBD) with three replications. 5-6 plants were allowed to grow in each pot. Twenty Mealy bugs of 2nd and 3rd instars were inoculated in each plant. After 20 days of inoculation, Mealybug infested plant were counted to find out % of mealy bug infestation.

Experiment 4: Study on biology of Mealybug of kenaf and Mesta

Study on biology of Mealybug was carried out in the laboratory of Entomology Department, BJRI, Dhaka following CRD design with 10 replications. Twigs of kenaf and Mesta plants infested with reproducing females of Mealybug were brought to the laboratory; individual females were separated, and fed on kenaf and Mesta leaves in Petri dishes. Individual kenaf and mesta leaf with petiole were collected from the plant terminal of the *Hibiscus* sp. grown in net house without insecticidal spray and free from Mealybug infestation, washed with tap water and shade dried and used as food source. Since parthenogenesis reproduction of Mealybug was observed under field conditions, individual neonate crawlers emerging from females were used as to start the biology study. The laboratory temperature and mean relative humidity of the study area were recorded.

Observations on survival and molt of the crawlers were recorded daily under stereoscopic microscope until they became adults following CRD design with 10 replications. Three Petri dishes with missing crawlers were discarded and excluded from the final data. As the eggs or neonate crawlers were counted and discarded, the individual adults that produced them were transferred to new Petri dishes for further observations. When eggs were observed they were separated along with the leaf disc and observed until they hatched.

Experiment 5: Varietal Assessment and Yield Loss Assessment of kenaf and Mesta due to infestation of Mealybug

Experiment was carried out in the field of Rangpur regional station and Patuakhali sub-station during May to September, 2017. HC-95, HC-2, BJRI Kenaf -3 (Bot kenaf) and HS-24 variety were grown in the field. The unit plot size was 2.1m x 2m, row to row distance was 30cm and plot to

plot distance was 1m. The study was arranged in a Randomized Complete Block Design (RCBD) with 6 replications. The natural infestation of mealy bug was encouraged to build up in the field except control plots. In the experiments, control pots were treated with Sevin 85% WP with the dose 1.5gm/ liter water for three times at an interval of 15 days till harvest. Data were collected on plant height, base diameter, fibre weight and stick weight.

The percent loss in yield was calculated using the following formula:

$$\text{Percent loss in yield} = \frac{X_1 - X_2}{X_1} \times 100$$

Where, X_1 is the mean yield in treated (control) plots

X_2 is the mean yield of infested plots.

Experiment6: Development of Management technique against Mealybug of kenaf

The experiment was carried out at two different locations. Pot experiment was conducted at net house of Bangladesh Jute Research Institute (BJRI) and field experiment was conducted at Jute Agriculture Experimental Station (JAES), Manikganj during the kenaf and Mesta growing season (May-August) 2018. Seven insecticides of different generic group with control were used in this experiment which were:

Treatments

- T₁= Sevin 85SP
- T₂= Nitro 505EC
- T₃= Ecomecs
- T₄= Neemplus
- T₅= Neem seed kernel extract
- T₆= Phyto clean
- T₇= Detergent powder+ Sevin 85SP
- T₈= Control

Pot experiment

BJRI bot kenaf was grown in earthen pot at net house premises of Central station, BJRI, Dhaka. Plants were grown in pot following Randomized Complete Block Design (RCBD) with five replications. There were 5-6 plants in each pot allowed to grow. Fifty mealybugs of 2nd and 3rd instar were inoculated in each plant twig of the pot after 60 days of sowing. Seven insecticides such as Sevin 85SP, Nitro 505EC, Ecomecs , Bioneem plus, Neem seed kernel extract Phyto kill, Detergent powder+ Sevin 85SP at their respective doses were sprayed after 60 days of inoculation.



Fig. Pot experiment

Control pots were kept untreated. Mealy bug population/twig before spray was recorded before spray and at 3rd and 5th day after spray. Data of % mortality at 5th day after spray were analyzed.

Percent mortality were calculated at 5th days after spray over control in each treatment was calculated by using the following formula

$$\% \text{ Corrected Mortality} = \left(1 - \frac{T_a \times C_b}{T_b \times C_a} \right) \times 100$$

T_a = No. of mites after treatment

T_b = No. of mites before treatment

C_a = No. of mites after treatment in control

C_b = No. of mites before treatment in control

Data were analyzed by Statistix 10 software and multiple means comparison was executed following LSD value.

Field experiment

Field experiment was conducted at JAES, Manikganj. The jute variety O-9897 was grown in unit plot size of 2 x 2.1 m² with three replication following Randomized Complete Block Design (RCBD) with three replications. Seven insecticides such as Sevin 85SP, Nitro 505EC, Ecomecs , Bioneem plus, Neem seed kernel extract Phyto kill, Detergent powder+ Sevin 85SP at their respective doses were sprayed @ 1.7 kg/ha, 1 L/ha, 500 ml/ha, 1 L/ha, 1: 10, 2.5L/ha, 1.7 kg/ha, respectively were sprayed after 60 days of sowing when sufficient infestation was found in the plot naturally.



Fig. Field experiment

No insecticide was sprayed in control plots. Population of Mealybugs in each twig of the plot was recorded before spray and at 3rd and 7th days after spray.

Percent reduction of infestation over control was calculated following a formula given below:

$$\% \text{Reduction over control} = \frac{\text{No. of insects in control plot} - \text{No. of insects in treated plot}}{\text{No. of insects in control Plot}} \times 100$$

Data were analyzed by Statistics 10 software and multiple means comparison was executed following LSD value.

08. Results and discussion:

Experiment-1: Survey and collection of samples of Mealybug from different places

Surveillance and Monitoring of pest is essential for pest forecasting which will also provide correct timing of management of insect's pest population. The intensity of insect pest infestation varies from variety to variety and region to region. Survey on Mealybugs of Kenaf and Mesta is needed to obtain record on this time of appearance, peak period of infestation and to take necessary control measures at proper time specially to know the percentage of different Mealybug incidence in different kenaf and mesta varieties at different agro ecological zones and comparative assessment of incidence of Mealybug in experimental plots and farmers' fields.

Table 1: Incidence of Mealy bugs in Kenaf and Mesta plant in different locations

Date	Location	Surrounding existing crop	Crop/Variety	Plant No./m ² Or PP/plot	Infested plant/m ² Or plot	% infestation	Plant age (day)	Infested part(Twig=T, Leaf=L, Stem, Base =B)
30.07.17	Patuakhali	Fellow	HC-95	31.5	8.5	38.96	95	T, S
			Bot kenaf-3	39.5	18.5	49.35	95	T
			HS-24	29	3	10.34	95	T, B
13.09.17	Faridpur	Lentil	HC-95	39	25	37.22	100	T, L
			Jute	50	1	0.5	120	T
	Narayanganj	Jute	HC-95	41	33	80.49	91	T
			HS-24	44	30	73.08	91	T
			Bot kenaf-3	37	15.67	42.41	91	T
25.09.17	Comilla	Kenaf	HC-2	63.25	25.75	40.74	100	T, L
			Bot kenaf-3	59.67	28.67	49.68	100	T
			HC-95	34	13	38.24	100	T
			Jute	49	8	17.67	50	T, L
17.08.17	Dhonbari	Rice	HC-95	36.75	0	0	90	T
	Gopalpur,	Rice	HC-95	35	0	0	95	-
	Madupur	Fellow	HC-95	31.4	4.8	15.57	100	T



Fig 1. Mealy bug infested field of kenaf at Central station, Dhaka.



Fig 2. Mealy bug infested field of jute at Central station, Dhaka



Fig 3. Mealy bug infested field of jute at Faridpur regional station, Dhaka



Fig 4: Mealy bug infested plant at Madupur, Tangail region



Fig 5. Mealy bug infested kenaf plant at Rangpur regional Station



Fig 6. Mealy bug infested kenaf plant at Chandina regional Station



Fig 7. Mealy bug infested jute plants at Chandina regional Station



Fig 8. Mealy bug infested kenaf and mesta plants at Tarabo, Narayanganj sub-Station



Fig 9. Mealy bug infested Mesta plants at Patuakhali sub-Station

From the above table 1, it was observed that height infestation of Mealybug (80.49%) was found in HC-95 of kenaf variety at Narayanganj sub-station and lowest infestation of Mealybug (11.34%) was found in HS-24 of Mesta variety at Patuakhali sub-station of BJRI. Most infested part of plant was twig. No Mealybug infestation was found in Dhonbari and Gopalpur of Tangail region. On the other hand, in Cumilla and Faridpur Mealybug infestation was found in jute plant especially in O-9897 and O-795 variety.

Experiment 2: Development rearing technique of Mealybug

Among the rearing media, kenaf and Mesta plant and sprouting potato were very good rearing media of Mealybug. These are very easy rearing technique of Mealybug.



Fig 10. Mealybug rearing on Mesta



Fig 11. Mealybug rearing on sprouting potato



Fig 12. Mealybug rearing on pumpkin

Experiment 3: Study on host range Mealybug of kenaf and Mesta

Percent Mealybug infestations of kenaf and Mesta were recorded after 20 days of Mealybug inoculation. Among different host plants, Mealybug infestation 72.22, 83.33, 66.67 and 88.89% were recorded in Guava, tomato, potato and brinjal plant respectively but none of Mealybug infestation was found in papaya and Chilli plant respectively.

Table 2. Percent of Mealybug infestation on different host plant

Name of host plant	No. of total plant/pot	No. of Mealybug infested plant/pot	% of Mealybug infestation
Papaya	18	0	0.00
Guava	18	13	72.22
Tomato	18	15	83.33
Potato	18	12	66.67
Chilli	18	0	0.00
Brinjal	18	16	88.89

Experiment 4 : Study on biology of Mealybug of kenaf and mesta

Hence, the present research was conducted to study the life cycle of Mealybugs of kenaf and mesta on host plant and it reported in the current study.

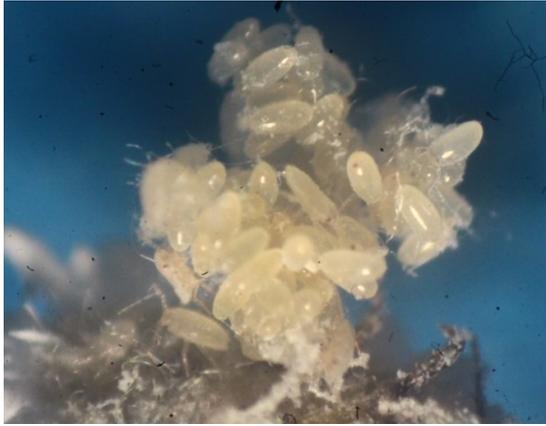


Fig 13. Egg masses of Mealybug (3.5 X)



Fig 14. First molting of neonate crawler (3.5 X)



Fig 15: Second instar (3.5 X)



Fig 16. Third instar (3.5 X)



Fig 17. Adult (3.5 X)

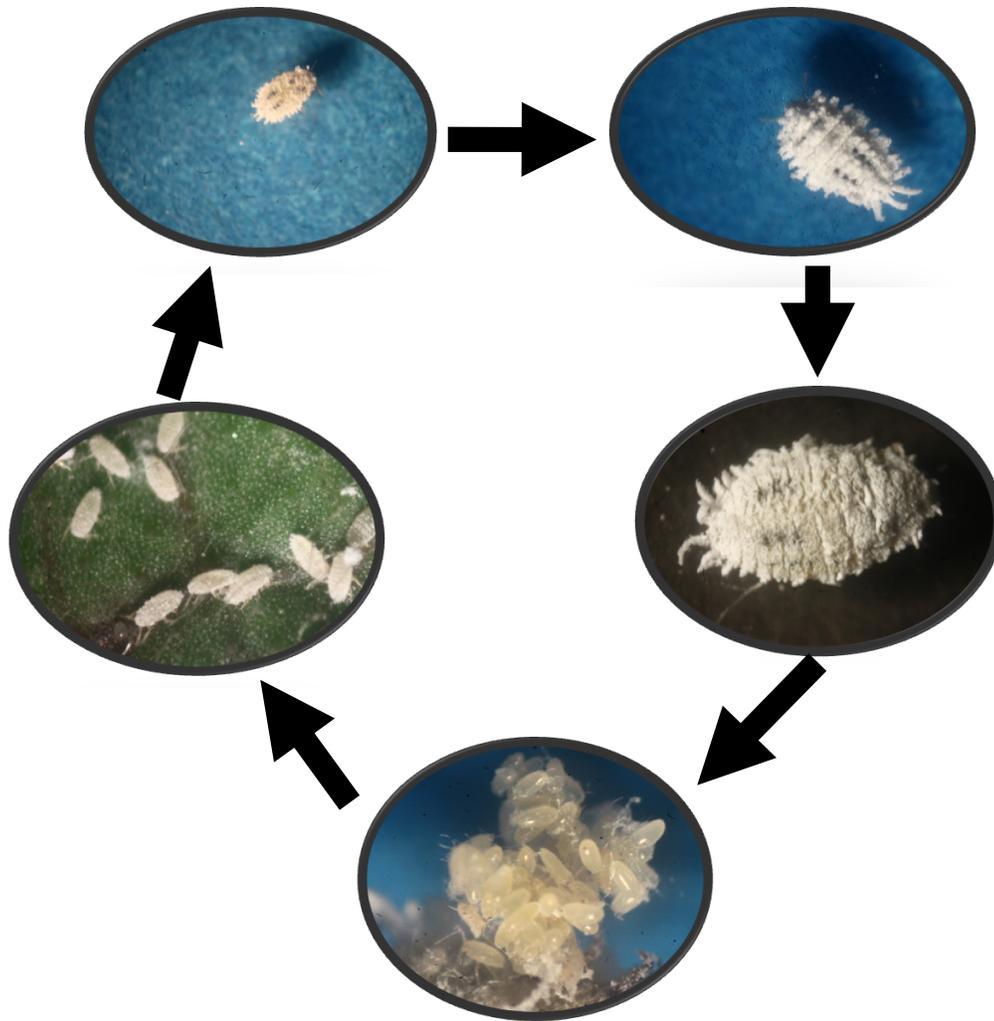


Fig 18. Life cycle of Mealybug

Table 3. Time duration required for different stages in the life cycle of Mealybug

Pot No	1 st stage (days)	2 nd Stage (days)	3 rd stage (days)	adult (days)	Total life span (days)
R1	4	9	7	16	37
R2	4	8	8	15	35
R3	3	7	9	14	33
R4	4	6	8	15	33
R5	3	7	7	17	34
R6	4	6	7	18	35
R7	3	7	8	17	35
Range	3-4	6-9	7-9	14-18	33-37
Mean±SD	3.57±0.534	7.14±1.069	7.71±0.755	16±1.414	34.57±1.397

Result and Discussion:

The life cycle of Mealybug was 35-37 days, duration of 1st instars 3-4 days, 2nd instars 6-9 days 3rd instars 7-9 days and adult 14-18 days. The developmental period of crawlers of *P. vargitus* was shorter and similar for second and third instars (6-9 days), and longer for the adult (14–18 days). Mean developmental periods of first, second, third instars and adult were 3.57±0.534, 7.14±1.069, 7.71±0.755 and 16±1.414 days, respectively. Under laboratory conditions, the typical occurrence of an ovisac was missing although neonates or eggs were entangled in hyaline waxy thread-like structures.

During the study period, temperature and relative humidity were recorded. The monthly mean, maximum and minimum temperature, and relative humidity were: August (31.5°C, 39.35°C and 27.2°C and 82%), September (31.5°C, 29.05°C and 26.6°C and 82.0%) and October (31.5°C, 28.0°C and 24.5° C and 79.5%).

Experiment 5: Varietal Assessment and Yield Loss Assessment of kenaf and Mesta due to infestation of Mealybug

Three varieties of kenaf HC-95, HC-2, BJRI Kenaf -3 (Bot kenaf) and one variety of Mesta (HS-24) were grown in the field and showed various level of mealy bug infestation. Among the kenaf and mesta varieties, BJRI Kenaf -3 (Bot kenaf) showed the highest level of mealy bug infestation (73.59%) causing 34.26% fibre yield loss at Rangpur station but infestation at Patuakhali sub-station was 47.98% causing 32.73% fibre yield loss. Overall, Mealybug infestation level was more at Rangpur regional station than that of Patuakhali sub station.

Table 3. Infestation level of mealy bug and assessment of yield loss of different variety of kenaf and Mesta due to mealy bug infestation, 2017

Variety	% Mealy bug infested plant		Fibre weight (kg)/50 plant		Stick weight (kg)/50 plant		% Yield loss (Fibre)	
	Pat.	Rangpur	Pat.	Rangpur	Pat.	Rangpur	Pat.	Rangpur
HC-95	34.11 a	62.39 ab	0.712 b	1.107 bc	1.684 bc	2.167 b	28.97ab	25.59 a
HC-95 Control		4.53 c	1.003 a	1.487 a	2.783 a	3.533 a		
HC-2	32.38 b	46.80 b	0.560 c	1.133 bc	1.686 bc	2.333 b	23.87 b	23.00 a
HC-2 Control		3.80 c	0.736 b	1.472 a	2.064 b	3.600 a		
BJRI Kenaf -3 (Bot kenaf)	47.98 a	73.59 a	0.538 c	0.940 cd	1.546 bc	2.200 b	32.73 a	34.26 a
BJRI Kenaf -3 (Bot kenaf) Control		4.75 c	0.799 b	1.430 ab	1.826 bc	4.000 a		
HS-24	7.16 c	66.67 ab	0.442 c	0.685 d	1.247 c	1.400 b	6.02 c	13.05 b
HS-24 Control		8.57 c	0.470 c	0.993 cd	1.520 bc	2.000 b		
CV (%)	9.283	44.59	0.124	16.47	0.667	24.65	7.438	23.44

*Pat= Patuakhali

Seven insecticides were applied at net house condition at recommended dosages effective in respect of mortality. Detailed results are given in table 4.

Table 4: Efficacy of insecticides on mortality of Mealybug in net house condition at Central station, Dhaka, BJRI.

Name of Insecticides	Dose/ha	Average Mealybug population/ twig before spray	% Average mortality of Mealybug after spray	
			at 24 th hour	at 48 th hour
Sevin 85 SP	1.7 kg/ha	50	73.2	92.60 b
Nitro 505 EC	1L/ ha	50	59.6	88.64 c
Ecomecs	500 ml / ha	50	52.8	84.56 d
Bio neem	1L/ ha	50	51.6	78.40 e
Neem seed karnel extract	1:10	50	47.2	74.40 f
Phyto kill	2.5 L/ha	50	69.2	92.40 b
Detergent Powder+ Sevin 85 SP	1.7 kg/ha	50	76.4	95.60 a
Control		50	0	-
CV (%)				2.81

At pot experiment, Seven insecticides such as Sevin 85SP, Nitro 505EC, Ecomecs , Bioneem plus, Neem seed kernel extract, Phyto kill, Detergent powder+ Sevin 85SP @ 1.7 kg/ha, 1 L/ha, 500 ml/ha, 1 L/ha, 1: 10, 2.5L/ha, 1.7 kg/ha, respectively were sprayed after 60 days of sowing for controlling Mealybug.

From the Table 4 it was revealed that those insecticides were found effective against Mealybugs giving 92.60, 88.64, 84.56, 78.40, 74.40, 92.40 and 95.60 % mortality of Mealybugs over control plot respectively. The highest percent mortality of Mealybug (95.60%) was found from the plot treated with Detergent Powder+ Sevin 85 SP which was statistically different from others treatments. The lowest percent mortality of Mealybug (74.40%) was found from the plot treated with Neem seed karnel extract over the control plot.

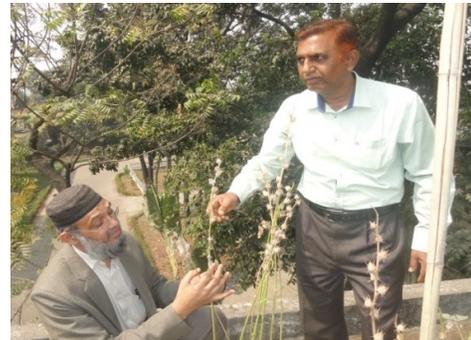
Table 5: Efficacy of prescribed doses of seven insecticides against Mealybug at JAES, Manikganj of BJRI.

SL. No.	Name of insecticides	Dose/ ha	Average Number of Mealybug/ plant twig before spray	% Reduction of infestation after spray	
				at 3 rd day	at 7 th day
1	Sevin 85 SP	1.7 kg/ha	159	73.14	87.37 bc
2	Nitro 505 EC	1L/ ha	141.67	69.29	83.49 cd
3	Ecomecs	500 ml / ha	157.33	61.82	80.47 d
4	Bio neem	1L/ ha	176	57.25	80.57 d
5	Neem seed karnel extract	1:10	197.33	50.71	71.27 e
6	Phyto kill	2.5 L/ha	176	72.56	91.45 ab
7	Detergent Powder+ Sevin	1.7 kg/ha	105	73.76	92.77 a
8	Control	-			
CV (%)					3.45

In a column, means followed by a common letter are not significantly different at 5% level of significance.

At field experiment, seven insecticides such as Sevin 85SP, Nitro 505EC, Ecomecs, Bioneem plus, Neem seed kernel extract, Phyto kill, Detergent powder+ Sevin 85SP @ 1.7 kg/ha, 1 L/ha, 500 ml/ha, 1 L/ha, 1: 10, 2.5L/ha, 1.7 kg/ha, respectively were sprayed after 60 days of sowing for controlling Mealy bugs at Jute Agriculture experimental Station, Manikganj. From the Table 2 it was found that these insecticides were found effective against mealybug giving 87.37, 83.49, 80.47, 80.57, 71.27, 92.27, 91.45, and 92.77% reduction of infestation over control plot, respectively. The highest percent reduction of Mealybug infestation (92.77%) was found from the plot treated Detergent Powder+ Sevin 85 SP which was statistically similar with phytokill but different from others. The lowest percent reduction of yellow mite (80.47%) was found from the plot treated with Ecomecs which was statistically similar with Ecomecs over the control plot.

Some pictorial view of project activities visited by monitoring team



9. Research highlight/findings (Bullet point – max 10 nos.):

- The highest infestation of Mealybug (80.49%) was found in BJRI kenaf variety at Narayanganj sub-station of BJRI and most infested part of plant was twig.
- Mealybug infestation was also found in jute plant especially in O-9897 and O-795 variety in Faridpur and Cumilla regional station of BJRI.
- Alternate host Mealybug of kenaf and Mesta were found potato, tomato, brinjal and guava.
- Rearing technique of Mealybug was developed on sprouting potato and pumpkin (sweet gourd) in laboratory condition.
- Among the kenaf and mesta varieties, BJRI Kenaf -3 (Bot kenaf) was most susceptible to mealy bug where the highest level of mealy bug infestation was 73.59% causing 34.36% fibre yield loss at Rangpur station.
- The life cycle of Mealybug was 35-37 days, duration of 1st instars 3-4 days, 2nd instars 6-9days 3rd instars 7-9 days and adult 14-18 days.
- Phytoclean (Bio-pesticide) and Sevin 85SP were most effective for controlling mealybug.

B. Implementation Position

1. Procurement:

Description of equipment and capital items	PP Target		Achievement		Remarks
	Phy (#)	Fin (Tk)	Phy (#)	Fin (Tk)	
(a) Office equipment	Computer & accessories a) Laptop b) Desktop Computer c) UPS d) Scanner e) Laser Jet Printer b) Digital Camera	5600.00 5500.00 8000.00 9000.00 18000.00 23500.00	a) Laptop b) Desktop Computer c) UPS d) Scanner e) Laser Jet Printer b) Digital Camera (100%)	5600.00 5500.00 8000.00 9000.00 18000.00 23500.00 (100%)	Procured items are being used by the scientists of Entomology Determent
(b) Lab &field equipment	Sprayer machine	8000.00	Sprayer machine (100%)	8000.00 (100%)	Procured items are being used by the scientists of Entomology Determent
(c) Other capital items	a) Executive Table b) Executive Chair c) Front Chair d) Computer table e) Computer chair f) Steel almira g) File cabinet	17000.00 8500.00 14000.00 4500.00 3000.00 20000.00 16500.00	a) Executive Table b) Executive Chair c) Front Chair d) Computer table e) Computer chair f) Steel almira g) File cabinet (100%)	17000.00 8500.00 14000.00 4500.00 3000.00 20000.00 16500.00 (100%)	Procured items are being used by the scientists of Entomology Determent

Equipment and furniture procured for the project



Desktop Computer



CPU



Laser Jet Printer



Scanner



UPS



Digital Camera



Executive Chair



Executive Table



Computer Chair



File Cabinet



Steel almira



Laptop



Computer Table



Front Chair



sprayer machine

2. Establishment/renovation facilities: (Not Applicable)

Description of facilities	Newly established		Upgraded/refurbished		Remarks
	PP Target	Achievement	PP Target	Achievement	
N/A	N/A	N/A	N/A	N/A	Not Applicable

3. Training/study tour/ seminar/workshop/conference organized: (Not Applicable)

Description	Number of participant			Duration (Days/weeks/ months)	Remarks
	Male	Female	Total		
(a) Training	-	-	-	-	Not Applicable
(b) Workshop	-	-	-	-	

C. Financial and physical progress

Fig in Tk

Items of expenditure/activities	Total approved budget	Fund received	Actual expenditure	Balance/ unspent	Physical progress (%)	Reasons for deviation
A. Contractual staff salary	213992	213992	213992	0	100%	
B. Field research/lab expenses and supplies	594707	583197.6	583198		100%	-
C. Operating expenses	151380	146542	146542	0	100%	-
D. Vehicle hire and fuel, oil & maintenance	43315	37048.4	37048	0	100%	-
E. Training/workshop/seminar etc.	-	-	-	-		-
F. Publications and printing	90000			0	0	-
G. Miscellaneous	80000	76902.8	76903	0	100%	-
H. Capital expenses	260600	260600	260600	0	100%	-

D. Achievement of Sub-project by objectives: (Tangible form)

Specific objectives of the sub-project	Major technical activities performed in respect of the set objectives	Output(i.e. product obtained, visible, measurable)	Outcome(short term effect of the research)
To increase per unit area kenaf and mesta yield	Survey, Seed , pesticides, manure and fertilizer	Suitable management practice developed.	Increased kenaf productivity by 15-30% at the completion of the project.
To study the biology, and host diversity of Mealybug	-Mealybug specimen collection and biological study -Study different types of alternate host	Improved technology	Majority of the kenaf and mesta grower will be benefitted by using these information.
To develop efficient and economic management technique to control Mealybug of kenaf and mesta	Pesticides application	Farmer's efficiency increase for Mealybug control	Farmer's income will be increased
To generate farmers' income reducing yield loss	Pesticides application		

E. Materials Development/Publication made under the Sub-project:

Publication	Number of publication		Remarks (e.g. paper title, name of journal, conference name, etc.)
	Under preparation	Completed and published	
Technology bulletin/ booklet/leaflet/flyer etc.	booklet = 1	-	Already one booklet have been submitted to PIU, BARC
Journal publication	2	-	Two journal would preparing
Information development	1. Mealybug infestation was also found in jute plant especially in O-9897 and O-795 variety. 2.Late sowing kenaf is more infested than early sowing kenaf		
Other publications, if any		-	

F. Technology/Knowledge generation/Policy Support (as applied):

i. Generation of technology (Commodity & Non-commodity)

Developed integrated management package against Mealybug of kenaf and Mesta which would help to improve/increase kenaf and Mesta productivity.

ii. Generation of new knowledge that help in developing more technology in future

This sub-project would possibly be helpful to generate new knowledge which help in Developing technology for management Mealybug of kenaf and Mesta. This new knowledge would be helpful to the Agricultural scientists of the country for technology generation as well as increasing production and productivity of kenaf and Mesta.

iii. Technology transferred that help increased agricultural productivity and farmers' income

By developing an efficient and economic management technique to control Mealybug of kenaf and Mesta. Project activities help to transfer the technologies for improving kenaf and Mesta productivity in country. As a result, farmer's income would be increased.

iv. Policy Support

Research findings of this project would be help to take action production program of kenaf and Mesta in whole over the country. It would helpful to the Agricultural scientists for designing their future research project in order to technology generation as well as increasing production and productivity. Research findings would also assist the policy makes of Agricultural sub-sectors for setting future research directions.

G. Information regarding Desk and Field Monitoring

i) Desk Monitoring [description & output of consultation meeting, monitoring workshops/seminars etc.):

Different monitoring team of BJRI and BARC had visited the project activities and they suggested that the project may be viable and would be help to the farmers for controlling Mealybug of kenaf and Mesta.

ii) Field Monitoring (time& No. of visit, Team visit and output):

Monitoring status

Monitoring team	Date of visit	No. of total visit till date	Remarks
Crops Division, BARC	15.02.2018	01	Honorable members of Crops Division of BARC observed the project activities and gave suggestions for conducting project research work successfully.
PIU-BARC,NATP-2	-	-	-
Internal Monitoring team, BJRI	15.05.2018 & 05.09.2018	02	Internal monitoring team of BJRI observed the project activities and they suggested finding out effective management for Mealybug of kenaf and Mesta.

H. Lesson Learned/Challenges (if any)

- i) Delaying of kenaf and Mesta cultivation more susceptible to Mealybug infestation.
- ii) Control measure should be taken at time of initial infestation of Mealybug.
- iii) Delay fund release hindered smoothly runs the project activities.

I. Challenges (if any)

- i) Kenaf and Mesta might be damaged by natural hazard like heavy rainfall, storm, flash flood etc. Management of kenaf and Mesta in natural stress is some time challenging and risky.

Signature of the Principal Investigator

Date

Seal

Counter signature of the Head of the organization/authorized representative

Date

Seal