PRE02001SI

Management of pink mealy bug *Maconellicoccus hirsutus* (Green) of mulberry with barrier System

Submitted by

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Ministry Textiles : Govt. of India
R.S.R.S. Jorhat- 785005, Assam.

PROFORMA – 1 (To be filled by applicant)

PART I: GENERAL INFORMATION

1.	Name of the institute University/Organization submitting the Project Proposal	Regional Sericultural Research Station, Central Silk Board, Ministry of Textile, Govt. of India , Jorhat-785005 , Assam
2.	Status of the institute	R&D
3.	Name(s) and designation(s) of the Executive Authority of the Institute/University forwarding the application	Director, Central Sericultural Research &Training Institute, Berhampore - 742101, Central Silk Board, West Bengal
4.	Project title	**Management of pink mealy bug *Maconellicoccus hirsutus* (Green) of Mulberry with barrier System**
5.	Category of the project	Entomology
6.	Section area	Control of Mealy bug pest in mulberry plant
7.	Duration	**July, 2018 to June, 2021 (3 years)**
8.	Total cost	**Rs. 9.43 Lakhs**
9.	Is the project single institutional/ multi-institutional	Single institutional
10.	If the project is multi-institutional, please furnish the following: Name, Designation and Address of the Project Coordinator.	

11. Project summary:

The pink mealy bug, *Maconellicoccus hirsutus* (Green) (Hemiptera: Pseudococcidae) has emerged as a major pest of mulberry. This polyphagous pest has been able to survive due its highly adaptive mechanisms comprising of high rate of reproduction both sexually and asexually, protective waxy coat, diversity in host plant selection, hiding in remote places like wrinkled leaves, cracks, roots, nearby vegetations and dispersion through abiotic and biotic means. The extent of crop loss due to mealy bug infestation in mulberry is 15%. In spite of adoption of various control measures in the line of IPM, mealy bug still remains as havoc to the mulberry sericulture.

In the light of the above, a new strategy has been formulated to kill the young 1st instar mealy bug called as crawlers which are very delicate and most vulnerable stage without protective coat in the life circle of mealy bug. This complies with the principle of insect pest control. Secondly the mealy bugs, mostly the crawlers go out from the mulberry field at the adverse condition such as in dry winter or in pruning season and take shelter in the nearby vegetation. Again they return back to mulberry field at the time of new sprouting. That is why the border line of mulberry plants gets infested heavily. Keeping this observation in mind, insecticides should be sprayed as soon as the crawlers are detected in the mulberry field and a barrier should be made surrounding the mulberry plot in the form of drain fortified with different insecticides. Special method of detection of newly hatched mealy bug (crawlers) is adopted by keeping black paper plate, hollow glass tube, sticky traps etc. The tiny young mealy bugs are easily visible in these articles. The spraying of insecticides will not be done in 15 day interval as practiced in conventional method but has to be sprayed both in the soil and plants as soon as detection of crawlers after the post pruning period. Simultaneously there will be a chemical barrier surrounding the mulberry field for blocking the inward and outward movement of mealy bug. Thus the protection of mulberry plot starts right from the day of pruning operation. This type of strategy will virtually reduce the mealy bug population as earlier workers have not studied so far in this direction.

PART II: PARTICULARS OF INVESTGATOR

12.	Name Date of birth Sex Indicate whether Principal investigator/Co-investigator Designation Department Institute/University Address No. of projects being handled by investigator at present	Shri Uttam Chandra Boruah 28-07-20-1958 Male Principal investigator Scientist D Regional Sericultural Research Station, Central Silk Board, Ministry of Textile, Govt. of India , Jorhat-785005 (Assam) 2 nos. collaborative Project as CI
13	Name Date of birth Sex Indicate whether Principal investigator/Co-investigator Designation Department Institute/University Address No. of projects being handled by investigator at present	Dr. S.N. Gogoi 01. 11.1958 Male Co- Investigator Scientist-D Regional Sericultural Research Station, Central Silk Board, Ministry of Textile, Govt. of India , Jorhat-785005 (Assam)

PART III. TECHNICAL DETAILS OF PROJECT

14.1. Introduction

The pink mealy bug, *Maconellicoccus hirsutus* (Green)(Hemiptera:Pseudococcidae) is a key pest of mulberry. This polyphagous pest infests more than 300 host plants, so it can survive while mulberry crop is not available. The saccivorous pest, pink mealy bug causes 15% damages to the mulberry plant not only due to sucking the plant sap but also they inject toxic saliva into the plant while feeding. The formation of malformed leaf and shoots, stunted growth with curling of the leaves similar to damage caused by viral pathogen is observed. The symptom developed by the feeding of pink mealy bug on mulberry is commonly known as '**Tukra**'. The mealy bug nymphs are mobile and they move to the tender growing parts of the plant. Moreover, they are dispersed by abiotic means *viz*. irrigation and wind as well as biotic means *viz*. ants, human and some animals. The management of pink mealy bug is a problem due to its protective cover made of wax, hiding habitat under curled leaves, cracks, roots soil etc. and its rapid multiplication rate both by sexually and asexually (Parthenogenesis). That is why it is regarded as "HARD TO KILL PEST".

Presently the IPM package of practice for control of Tukra is as follows- (**A.V. Marry Josefa and *et. al.***)

1. **Mechanical**: Clipping and destruction of infested portions by burning.
2. **Chemical**: Spray of 0.2% DDVP (76EC) @2.63 ml/litre 12 to 15 days after pruning. For severe infestation spray one more dose after 10 days
3. **Biological:** Release of predators-Cryptolaemus montrouzieri @ 250 adults pairs/acre in two split doses: Oct- Nov. and Jan or Scymnus coccivora-@ 500 adult pairs/acre in two split doses: Oct- Nov. and Jan – Feb.

In spite of adoption of IPM package of practices, mealy bug is still causing crop loss contributing to the shortfall of silk production in national level. The causes of failure to control the mealy bug are assumed as waxy protective layers of nymphal stage, hiding nature of the mealy bug inside the buds and highly curling leaves, sheltering in inaccessible cracks, inward and outward movement of the nymphs, during the adverse conditions. Our field observations in a preliminary study reveal the following points:-

1. The newly hatched mealy bugs are very small in size measuring 0.37 mm long. They are very delicate having no protective waxy layer. This 1st nymphal stage of mealy bug is called as "Crawler stage". That is why crawlers are highly to prone to insecticides.

2. The Crawlers can walk 6 inches distance per hour i.e. 12 ft a day which is enough to travel from plot to plot or plant to plant as per our own observations in laboratory conditions.
3. The boundary rows of mulberry plant are more infested by Mealy bug than the inside ones. This reveals that the crawlers come from the nearby area and attack the boarder lines heavily.
4. The mealy bug can reproduce by Parthenogenesis which increases the rate of multiplication.
5. The hatching of mealy bug is not occurred at a time which is depending upon the availability of matured female. The most important thing is that chemical spraying with a interval of 15 days may miss the target. Because the crawlers hatch at different days in accordance with maturity of the adult mealy bug. Hence, the young crawlers can settle in the apical portion of the mulberry plant at any time within the interval of 15 days. In this way they hide themselves inside the bud and start sucking the sap without coming into contact with the insecticides
6. The female cannot fly but crawl to nearby plant or plot for food or shelter.
7. The clipping of infested mulberry tips results the loss of biomass and it prevent the further growing of the main stem from the infested tip.
8. The release of predatory beetles is hindered by lack of mass production locally.
9. The matured nymphs of mealy bug go outside from the pruned plot to nearby habitat in search of food and shelter.
10. The last but not the least, mealy bug crawlers can travel through soil due to very small size to avoid enemies and chemical as well.

By considering the above points, it is imperative to prepare an integrated approach to control the mealy bug by destroying the Crawler stage. As per principles of pest management, the weakest point of the life circle of the pest has to be targeted to minimize the use of insecticide. (Dhalial ,1996). Here the crawlers of mealy bug i.e. the 1st nymphal stage are very delicate without a waxy protective coat and can be killed easily **by timely spraying of chemical**. The exact of spraying of chemical is worked out by detecting the young crawlers by an especial method. More over various types of barriers, chemical or mechanical may be used surrounding the mulberry plot which will stop the movement of the mealy bugs from plot to plot and also from nearby vegetation. Scientists use the adhesive band (Sticky) as barrier to prevent movement of mealy bug in horticultural plants. But it is not possible in individual mulberry plants due to cost effectiveness. Keeping this point of view in mind, a special strategy to kill the Crawlers (1^{st} stage nymph) and to resist their movement from plot to plot is necessary to contain the mealy bug. Hence, a programme has been worked **out to control the mealy bug for the 1^{st} time as a part of IPM with the following objectives.**

14.2.Origin of the problem/rational of the study :

The use of chemical insecticides in all the stages of mealy bug needs in large amount which affect the cost effectiveness of the control programme. The later stages of the mealy bug attain a waxy protective coat which is anti-insecticidal in nature and that is why mealy fall in the hard to kill category of insect. The present practice of spraying of insecticide right from pruning operation in an interval of 15 days is not full proof because hatching of meal bug is not occurred at a time like silkworm egg; it may be a continuous process in the mulberry field. If the mealy bug hatch in the 4^{th} day of the 1^{st} spraying it may go to the tip of the new sprouting well before the next spraying (on 15^{th} day) because the duration of the 1st stage of mealy bug is only 4-5 days and in the meantime they attain the protective shield and hide themselves in cracks and apical bud of mulberry plants. The detection of tiny crawlers is difficult due to very minute size, creamy body colour resembling the soil and capable of crawling inside the tilled soil. Hence a special method of detecting the appearance of crawlers is extremely necessary. If mealy bug is not controlled properly, infestation of mealy bug in the form of Tukra become prominent in at the time of harvesting of leaves for silkworms rearing. Hence, it is imperative to kill the mealy bug in the nip of the bud i.e. the unprotected, delicate crawler stage (1st stage young mealy bug).

14.3. Relevance to the current issues and expected outcome

As the mealy bug is still not fully controlled in mulberry it is envisaged that this project with a new strategy will contribute to the management of mealy bug through IPM. The project also envisages a suitable package for control of mealy bug both chemically and mechanically. Materials used are easily available to adopt the technology with minimum budget which will emerge as a user friendly technology. The sericulture farmers will be benefited by acquiring a mealy bug free mulberry field which in turn yield more mulberry leaves and ultimately increase the return of the farmers as well as the raw silk production in national level.

14.4 Objectives

I. To increase the silk production by reducing the mulberry crop loss due to infestation of pink mealy bug.

II. To find out the minimum strategy to combat against mealy bug without adverse effect on environment.

15. Review of status of research and development on the subject

15.1 International status

The relevant research information on barrier system surrounding the mulberry plantation is scanty. However natural barriers with secondary host plants like pigeon pea, bajra etc are in the boundary or inside the field as inter cropping in the cotton plantation. Preferably the intercropping is practiced in the boundary for keeping the mealy bug away from the mulberry practiced plantation. The mango plants are also protected from mealy bug by applying a sticky band in base of the trunk which is not possible in mulberry as the sticky band cannot be tied to each and every mulberry plants due to large quantity. The biology pink mealy bug *Maconellicoccus hirsutus* (Green) was studied by Hakim et al 2012 and found that male mealy bug has 4 instar while the female has 3 instar. The male has 2 wings and can fly. The female mealy bug has no wing and cannot fly. The female adult are similar to 3rd stage nymph as it covered by a waxy coat. Those female who fails to copulate undergoes Pathogenesis reproduction. Neem, Azadirachta indicaAJuss(Fam. Meliaceae is indigenous to India has been popular in Indian folk because of medicinal and insecticidal value. Due to its legendary insect-repelle and medicinal properties, it has been identified as most promising of all plants by the National Research Council, Washington USA (NRC, 1992) The chlorpyriphos 20EC is found to be lesser hazardous to eco system than the dimethorate(ROGOR), DDVS etc.

World Health Organization (WHO) classified Chlorpyriphos as moderately hazardous pesticide as it has less toxicity to eco system. (NPIC)

15.2 National status.

Satyaprasad et al (2000) reported that mealy bug incidence caused cause an estimated loss in leaf yield of 4500 kg/ha/yr (34.24%) and more than 30% which sometimes reaches up to to 50% as reported by Vijoya Kumar, 2014). It is reported that mulberry mealy bug is a serious polyphagous pest feeding voraciously on mulberry leaves. (Tiwari et al 1994). The female has numerous duct and pores around the ovipositional opening which are responsible for secrete the waxy coat (Kumar et al 1997). Each adult female lays 150-600 eggs over a period of one week and hatch in 6-9 days (Moni, 1989). Not only the crawlers (1st instar), but also other stages of mealy bug are found to move to the nearby vegetations for food and shelter. The Gravid female forms a white waxy pouch where eggs are laid in the cracks, nearby vegetations, etc.

R K Tanwa, 2007 reported that mealy bug population can be reduced by barrier plantations of secondary host plants in like pigeon pea, maize etc in cotton plantation. He also suggested spraying Chlorpyiphos 2ml/ litre to control mealy bug on cotton. B.Kumar and B. Chjandra studied the effect of Chlorpyiphoson chilly and ensured that the chilly fruit are safe for consumer. The Chlorpyiphos is organo-phosphorus, non-systemic insecticide and

registered for use in more than 40 food commodities. It kills the insect by attacking nrvous system. IARI, New Delhi recommended Chlorpyiphos as pesticides.

The present intention of this project is to construct barriers in the borders of the mulberry field to restrict the movement of mealy bug from plot to plot and plant to plant. The barrier is consist of chemical insecticides, biological insecticides, lime powder, ash etc. Sufficient literature regarding the management of mealy bug in mulberry through barrier system is not available. The special strategy targeting the most vulnerable nympal stage ie crawler is attempted for the first time.

15.3. Importance of the proposed project in the context of current status.

The current status is that mealy is not fully controlled in spite of adoption of IPM package of practices. There may be some lacunae in the present practices such as spraying of insecticide at an interval of 15 days. Because the nymphs that hatch on 4^{th} or 5^{th} day of 1^{st} spraying may settle inside the bud well before the next dose of spraying on 15th day. Hence the spraying of insecticide after the pruning operation at an interval of 15 day is not advisable. It should be done as soon as the appearance of the Nymph (Crawlers)

All the methodologies of the IPM are not may be feasible in the farmer's level. For example release of biological predator like lady bird beetles which is difficult to handle by the farmers and the availability of the predators in large quantity is also may be remote. The study on killing the mealy bug in the crawler stage is not done in a systematic manner. Moreover, inward and outward movement of the crawlers from inside and outside of the mulberry field may be blocked through barrier system which is also not studied so far. The present project is taken to concentrate our attention to kill the young mealy bug with a continuous and comprehensive monitoring system. The present project proposal has the potentiality to solve the following problems

1. Timely detection of newly hatched mealy bug in the form of crawlers. Special innovative tools can detect the tiny nymphs even below the soil
2. It will help to predict the first appearance of the adult mealy bug may give warning to the farmers
3. It will solve the problem of polluted leaves as the mealy bug is reduced in the earlier stages.
4. It blocks the marching of large nos. of mealy bug crawlers from inside to outside after the pruning operation and compelling them to die inside the plot. Likewise during the flushing of mulberry bushes no mealy bug comes from outside.
5. Lastly, the farmers can increase the leaf yield by compensating the loss (15%) which is stated as 7 kg cocoon per acre/crop.

15.4. Anticipated products, progress/technology package, information or other outcome from the project and their expected utility.

As there is a gap in solving the mealy bug problem in mulberry, the project with new strategy will contribute to solve the mealy bug problem remarkably. The project envisages a suitable package to control mealy bug both chemically and mechanically. Materials used are easily available to adopt the technology with minimum budget. The sericulture farmers will be benefitted by acquiring a mealy bug free mulberry field which in turn yield more mulberry leaves and ultimately increase the return of the farmers and raw silk production as well.

15.5.Expertise available with the proposed investigation group /institution on the subject of the project :

Adequate expertise is available in the RSRS Jorhat, Assam Agricultural University, Jorhat and CSR&TI, Berhampore for carrying out the project in a proper direction.

15.6 Name and address of five Expert in the field.

Sl No.	Name	Designation	Address
1.	Dr. Badal Bhattarchyee	Professor	Assam Agricultural University, Jorhat, Assam
2.	Dr. T.V. Sathe	Professor	Department of Zoology Shivaji University, Kolhapur
3	Dr. M Mani	Principal Scientist	Head, Indian Institute of Horticultural research, Hessar-aghatta Lake Post, Bangalore

16.WORK PLAN

16.1 Work plan(Methodology/experimental design to accomplish the stated aim)

Methodology:

The main focusing point is to kill the most vulnerable crawlers (1st stage nymph) by way of ensuring the exact date of spraying of insecticides and resisting their movement by keeping boundary barriers with different insecticides. The young mealy bugs are easily visible when they crawl in the black paper due to their contrasting body colour. The black paper plate, sticky band, hollow pipes will be placed in the different locations of the mulberry plot to detect the appearance of young mealy bugs. The 1st spray of insecticide will be conducted just after the pruning mulberry plots. Thereafter, immediate spraying of spraying of **Chlorpyriphos 20EC** @ 3ml/L will be done as soon as the detection of the crawling nymph instead of waiting for next spray at the interval of 15 days. However the

spray is consisting of lesser formulation and covers the ground surface also Simultaneously, the entire boundary of the mulberry. Plot also will be surrounded by different barriers of both chemical and biological insecticides. The barriers also prevent on movement of other insect including ants which acts as a carrier of mealy bug.

Data on exact time of hatching and nos. of nymphs found in the black paper will be recorded before spraying. The growth parameter, leaf yield data and the mealy bug population will be recorded through 15 days interval. Obviously there will be only one experiment containing five treatments including the control one. Each treatment is consists of 4 replications in RBD. The control plot will be kept without barrier but with normal spraying of insecticides within the plot with a interval of 15 days.

Experiment No. 01: The resistance against movement of newly hatched crawlers of mealy bug with the help of barriers along with timely spraying of insecticide.

T1= Barrier with lime powder + spraying of Chlorpyriphos 20EC @ 3ml/L inside the plot.

T2= Barrier with husk ash (Suf) + spraying of Chlorpyriphos20EC @ 3ml/L inside the plot.

T3= Barrier with neem cake + spraying of Chlorpyriphos20EC @ 3ml/L inside the plot.

T4= Barrier with Chorpyphos mixed with saw dust + spraying of Chlorpyriphos20EC @ 3ml/L inside the plot.

T5 =without barrier on boundary **+** spraying of Chlorpyriphos20EC @ 3ml/L inside the plot. with 15 days interval (CONTROL)

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Chlorpyriphos 20EC @ 3ml/L **is to be sprayed with more frequency instead of once in a 15 days of intervals which depends upon the detection of crawlers.**

Plot Size **Plot length - 4 mt**

Plot Breadth - 3 mt.

No. of plants per plot- 20

Replication no. - 4

Cost effectiveness of the Project: (One acre plantation)

The spraying of insecticide in the mulberry field just after the pruning operation is a routine duty of the farmers. The time of next spraying is determined by the detection of mealy bug larvae (Crawler) with the help of black paper plates or hollow tubes kept in the soil. Otherwise, Spray will be continued with a interval of 15 days. The cost effectiveness of the project is as follows:-

A. Cost of insecticide Chlorpyriphos20 EC @ 3ml/L : 150 ml is required for 1 acre.

B. spraying in one acre land and the operation is repeated 4 times in a crop. Approximately, 1236 ft long barrier boundary is needed for one acre land divided into 3 plots.

1. Cost 150 ml Chlorpyripho@ Rs 350/-Lt. : Rs. 52.50
2. Total cost Chlorpyriphos (4 times) : Rs 210.00

C. Cost of Barriers (Barricade).

The barriers are consist of the following substances having insect repellent properties

1. Paddy husk ash 60 kg @ Rs 5.00 : Rs 300.00
2. Lime Powder 80 kg @ Rs. 10.00 Rs. 800.00
3. Neem cake (in bags) 50 kg @ Rs 870.00 Rs. 870.00
4. 50 kg Saw dust + 100 ml Chlorpyriphos 20EC Rs. 190.00
   (Rs 150.00 + Rs 40.00)

D. Cost of Black Paper :

Rs 150/- @ Rs 150.00/ Acre (15 nos. of 3x2 ft size of black paper)

E. Total cost-(Experiment wise)

1. Chlorpyriphos + paddy husk +black paper(210/- + 300/+150/-) = Rs 660.00
2. Chlorpyriphos + lime powder+ black paper (210/-+800/+150/-) = Rs 1160.00
3. Chlorpyriphos + Neem cake +black paper (210/-+870/-+150/-)= Rs 1230.00
4. Saw dust with Chlorpyriphos 20EC black paper (267/-+190/-+150/-)= Rs550.00

F. Income:

1. Excess leaf yield/acre/crop : 168 kg
2. Excess cocoon production : 7 kg
3. Excess income from cocoon @ Rs 300/kg : Rs 2100.00
   (On the basis of 10% increase in leaf yield)

Hence the profit after applying the technology:

1. Paddy husk ash (SUF)- Rs. 2100- Rs.660/- = Rs 1440.00
2. Lime powder- Rs. 2100- Rs1160/- = Rs. 960.00
3. Neem cake - Rs. 2100- Rs1250/-= Rs 850.00
4. Saw dust with DDVP- Rs 2100- Rs550/- = Rs. 1550.00

Farmer`s adaptability of the technology

The farmers use to keep a boundary drain in the periphery of the mulberry plots and that drain can be easily innovated as barriers of insecticides/ repellent to block the movement of mealy bug larvae. The Chlorpyriphos, Neem Cake, Saw Dust, Paddy Husk ash and lime are easily available in the market.

Even the paddy husk ash and Saw dust are found to be lying idle as waste in the Rice Mill and the Saw Mill. This technology will be applicable to other vegetable crops also. Henceforth farmers may adopt the technology within their financial capacity.

16.2 Organization of work elements

Sl. No.	Name	Designation	Time	Work to be done
1	Shri U.C. Boruah	Scientist- D	50 %	Preparation experimental plots, compilation and interpretation of data and final report submission
2	JRF	JRF	35 %	Spraying of insecticides and data collection. Data collection on the p[opulation of beneficial insects like lady mealy bug beetles.
3	Dr. S.N. Gogoi	Scientist- D	15 %	Monitoring the the project, Reviewing the progress and reporting the project time to time.

16.3. Proprietary/Patented items, if any expected to be used for this project :

The technology to be evolved will be CSB Property for management of mealy bug.

16.4.Suggested plan for action for utilization of the expected outcome from the project:

The expected outcome is a package of practices for control of mealy bug and may be used as a part of IPM. The farmers will able to acquire a mealy bug free mulberry plot.

16.5. Time schedule of activities giving milestones

Sl. No.	Activities	Symbol	Preceding	Estimated time.
1.	Selection of experimental site and preparation random design	A		3 months
2.	Preparation of Drain surrounding of the mulberry plot and	B	A	1 month

	application of insecticide			
3	Pruning of the plant and spraying of insecticide in the pruned plantation (Repetitions twice in a yr)	C	B	2 years 6 months
4.	Detection of crawlers and spraying of insecticide	D	C	1 year 6 months
5	Data collection on the p[opulation of beneficial insects like lady mealy bug beetles.	E	A	2 years 6 months
6	Data analysis, compilation of results and submission of the project.	F	ABCDE	3 months

16.6. Project Implementing Agency/Agencies

Name of the agency	Address of the agency	Proposed Research Aspect	Proposed amount (in laks)	Cost sharing (%)
Central Silk Board	Central Silk Board; Ministry of Textiles; Govt. of India ; Bangalore - 560 068	Mulberry pest control.	9.43	100

PART IV: BUDGET PARTCULAR

17. BUDGET: Rs.9.43 Lakhs

A. Non-recurring (e.g. equipments, accessories, etc)

S. No	**Item**	**1st year**	**2nd year**	**3rd year**	**Total**
1	Sprayer machine, (power operated) Plastic pipe etc.	0.50	0.10	0.10	0.70
2	Pruning knife, hoe etc	0.10	0.05	0.05	0 .20
Sub-total A=		**0.60**	**0.15**	**0.15**	**0.90**

B1.Manpower

Sl No	Position	Nos.	Consolidated emoluments	1st Year	2nd Year	3rd year	Total
1	Scientist	2	-	-	-	-	-
2	Technical staff	1	-	-	-	-	-
3	JRF	1	@Rs18000/ month	216000	216000	216000	648000
			Subtotal B1	216000	216000	216000	648000

B2. Consumables:

Sl. No.	Item	1st Year	2nd Year	3rd year	Total
1	Insecticides fertilzers etc.	0.15	0.15	0.15	0.45
2	Farm materials,display board etc.	0.15	0.15	0.15	0.45
3	Fuel for power tiller	0.15	0.10	0.10	0.35
4	Transportation	0.10	0.10	0.10	0.30
Sub total B2		**0.55**	**0.50**	**0.50**	**1.55**

C. Other items:

Sl. No.	Item	1st Year	2nd Year	3rd year	Total
1	Travel	0.05	0.05	0.05	0.15
2	Contingency	0.10	0.10	0.15	0.35
3	Overhead charges	0.00	0.00	0.00	0.00
Sub total		**0.15**	**0.15**	**0.20**	**0.50**
Grand total (A+B1+B2 +C)		**9.43 lakh**			

21. Part V: EXISTING FACILITY

Sl No.	Name of the equipment/Accessory	Make	Model	Funding agency	
1	Power tiller			CSB	1 no. in serviceable condition
2	Manpower MTS staff.			CSB	2 nos. MTS are to be used.
3	One JRF is required.			CSB	Emolument @Rs 18000/month

BIO DATA

1	**NAME**	:	SHRI UTTAM CHANDRA BORUAH.
2	**EMPLOYEE NO**	**:**	03773.
3	**OFFICIAL DESIGNATION**	**:**	SCIENTIST- D
4	**PROJECT DESIGNATION**	**:**	PRINCIPAL INVESTIGATOR
5	**EXPERTISE AREA**	**:**	SILKWORM PATHOLOGY AND MULBERRY PATHOLOGY.
6	**INSTITUTE NAME**	**:**	REGIONAL SERICULTURAL RESEARCH STATION UNDER CSR&TI, BERHAMPORE (W.B.).
7	**INSTITUTE ADDRESS**	**:**	REGIONAL SERICULTURAL RESEARCH STATION, CENTRAL SILK BOARD, ROWRIAH, JORHAT (ASSAM)
8	**TELEPHONE**	**:**	(0376) 2340069, 2311612.
9	**TELEX**	**:**	--
10	**FAX**	**:**	(0376) 2340513.
11	**BIRTH YEAR**	**:**	1958.
12	**SEX**	**:**	MALE.
13	**EDUCATIONAL**	**:**	

HIGHEST DEGREE (DEGREE ONWARDS)	YEAR	UNIVERSITY	COUNTRY	SUBJECT
M.Sc.	1981	Gauhati University	India	Zoology (Specialization in Entomology)
Pragya (Hindi)	2000	Department of Official language under Ministry of Home Affairs, Govt. of India.	India	

14. TRAINING UNDERGONE:

Course name/ Subject	Institute Address	Duration	Period		Sponsoring Agency	Remarks
			From	To		
Inservice training	CTR&TI, Ranchi	20 days	During June 1994.		MSDP, CSB, Guwahati.	Mass grainage operation in Tasar.
Capsule training	CSR&TI, Berhampore	7 days	19-4-99	24-4-99	RSRS, Jorhat (Assam)	Soil nutrient management.
Forest management	Rain & Moist Deciduous Forest Res. Institute, Jorhat.	1 day	28-2-99	-	- do -	Forest management
Statistical training	Assam Agril, University	10 days	1-8-2K	10-8-2K	- do -	Basic agricultural statistical analysis.
Summer training in mulberry pest and disease management.	CSR&TI, Berhampore	10 days	22-5-01	31-5-01	- do -	IPM
Seed production	SSTL, Kodathi	2 days	27-9-01	28-9-01	- do -	Seed production technology silkworm breeders.
DTS	Assam Ad-ministrative Staff college,Ghy	5 days	4-2-02	8-2-02	- do -	Direct training skills.
DOT	- do -	5 days	11-2-02	15-2-02	- do -	Design of training.
Biocontrol	PDBC, Bangalore	5 days	24-11-04	28-11-04	- do -	Mass production on predatory beetle *Coelophora unicolor.*
Chawki rearing	CSR&TI, Berhampore	7 days	During Nov'2005		Chawki rearing technology	

15. EXPERIENCE:

Organization/ Institute	Capacity/ Designation	Duration	Period		Subject/ Area	Significant achievement
			From	To		
MSDP, P_3 Unit, Jia, Arunachal Pradesh	SRA	5 years	10-3-89	31-6-94	Banya silk (Muga)	Rearing of seed crop and production of quality dfls. Raising of 3 x 3 m som plantation in 12 acres.
MSDP, P_4 Unit, Mendipathar, Garo Hills, Meghalaya.	SRA	5 years.	1-7-94	31-6-98	- do -	Rearing & maintenance of parent muga stock. Production of dfls increased 2-3 fold more than the target. Innovation of shock proof eggs transportation box.
RSRS, Jorhat (Assam)	SRA	1 year	1-7-98	28-2-99	Mulberry	Identification of Tulsi as anti viral agent as Grasserie disease. Preparation of forecasting model on mulberry diseases and pests and supply the same to different DOS of NE states. Popularization of various technologies through extension activities. Expansion of mulberry acreage, organization of Krishi mela, Field day, farmers day, Group discussion, group demonstration etc. Completion of survey on damage of mulberry plantation cause by flood during 1998 in Assam.
- do -	SRO	8 years	1-3-99	Till date	- do -	

16. PROJECTS PURSUED :

A. CURRENT PROJECTS/
PROJECTS UNDER PROGRESS

SL. NO.	PROJECT CODE	PROJECT TITLE
1.	-	Response to different types of pruning for maximization of leaf in mulberry (Pilot project).
2.	-	Studies on effect of some medicinal plants in controlling grasserie and flacherie diseases of mulberry silkworm (pilot project)
3.	ARP-3157	Studies on the effect of different essential oil of Occimum sp. For controlling Grasserie and Flacherie diseases of mulberry and muga silkworm.
4.	APP 002	Survey and surveillance of pests and diseases of mulberry and silkworm in N.E. region.
5.	ARP-3156	Studies on efficacy of *Coelophora unicolor* (Coleoptera: coccinellidae) as a bio-control agent against whitefly on mulberry.
6.	PRE-3345	Development of weather based forecasting models for major pests of mulberry in Jorhat, Assam. (Collaborative project with CSR&TI, Berham-pore).
7.	PIE 3222	All India Co-ordinated experimental trial for mulberry (AICEM II).
		Operational projects:
1.		Post authorization trials of newly approved silkworm breeds.
2		Demonstration of shoot feeding
.3		Preparation of Vermi compost and its utilization.
4.		Preparation of compost and its utilization
5.		Impact of package of practices for increasing productivity in mulberry sericulture. (TAVT). (0.5 acre of two plots).
6	**AIB-3466**	Development of region specific bivoltine breeds suitable for fluctuating and seasonally variable climatic conditions of Eastern & North-Eastern India.
7	**PPE-3517**	Population interactions of pests and natural enemies in mulberry eco-system.

17. PAPER PUBLISHED: Nil.

18. PAPER PRESENTED IN WORKSHOP:

1. Baruah, U.C., Chandra, A.K. and Chakravorty, R.(2000) Use of low cost rearing tray in minimizing cost of cocoon production. *Current Technology Seminar On Sericulture, 21-22 July, 2000, CSR&TI, Berhampore.*

2. Baruah, U.C., Chandra, A.K. and Chakravorty, R.(2000) Testing of new mulberry variety S_{1635} in the agroclimatic conditions of North-East region. *Current Technology Seminar On Sericulture, 21-22 July, 2000, CSR&TI, Berhampore.*

3. Sankar, M., Das, R., Baruah, U.C., and Chakravorty, R.(2000) Incidence of silkworm diseases and pests in the North Eastern states. *Current Technology Seminar On Sericulture, 21-22 July, 2000, CSR&TI, Berhampore.*

19. PAPER ACCEPTED FOR PUBLICATION:

1. Das, Ranuma, Neog, K., Pamehgam, M. and Boruah, U.C. Vermi Composting: An eco-friendly approach for fertilization of mulberry gardens in N.E. India. *(Indian Silk).*

PART VII: BIODATA OF PROJECT CO_ORDINATOR/PRINCIPAL INVESTIGATOR/ COINVESTIGATORS

1. CO- INVESTIGATOR:

1. Full name : Dr. Sumendra Nath Gogoi
2. Designation : Scientist-D
3. Department/Institute/University : Moriculture Division
4. Address for communication : Regional Sericultural Research Station
Central Silk Board, Govt. of India; Rowriah, Jorhat, Assam, India
5. Date of birth : 01.11.1958
6. Sex : Male
7. Education (Post graduation onwards and professional career)

Highest degree	Degree passed	University	Country	Subjects
M.Sc.	1981	Dibrugarh University	India	Life Science -Botany Cytogentics & Plant breeding)

8. Awards (Not required for in-house personnel)

Year	Award	Agency	Purpose	Nature
2008	Best Scientist	CSB	Development superior Som Variety (Godadhor)	

9. Positions held/Research experience in various institutions(Not required for in-house personnel)

Employer	Designation	Date of joining	Date of leaving
CSB	SRA	06.6.1984	Nil

10. Memberships/Fellowships (Not required for in-house personnel)

11. Patents: (Not required for in-house personnel)

12. Publications (Numbers only):

Books- 4, Research papers- 45 and General articles- 2

13. Projects submitted/being pursued/carried out by Investigator:

Sl. No.	**Title of the project**	**Funding agency**	**Duration**	**No. of Scientists**	**Total cost of the project (lakhs)**
1.	Survey collection of weed flora in mulberry plantation of Assam	CSB	1984-86	2	-
2.	Yield trial of improved mulberry varieties in different locations of Assam	CSB	1986-89	2	-
4	Yield trials of improved mulberry varieties in Nagaland	CSB	1989-1991	2	-
5	PIB-4637: Qualitative and quantitative improvement of muga host plant, *Persea bombycina* Kost through polyploidy	CSB	2002-2004	3	19.62
6	National Agricultural Technological Project	ICAR	2004-2006	3	beard by AAU, Jorhat, Assam
7	PIB-5838: Selection of promising som, *Persea bombycina (*King ex. Hook f.) Kost, genotypes for improvement of muga cocoon production in NE India.	CSB	2005-2009	3	36.3
8	PIB 5848: Evaluation of superior genotyope (s) of castor (*Ricinus communis* L.)	CSB	2007-2010	5	13.46
9	PPS-3435: Studies on micronutrients for sustained high productivity of quality mulberry in eastern and northeastern India		2010-2013	4	-
10	All India Coordinate experimental Trials for mulberry	CSB	2011-2015	2	-

11	B-JRH9P-19: Assessment of fertility status of mulberry growing soils in selected Seri villages of Jorhat district for appropriate fertilizers management.	CSB	20011-2013	1	-
12	Studies on the biology and efficiency of the coccinellid sp for management of whitefly on mulberry	CSB	20011-2013	2	-

14. Highlights of outcome/progress of the project (s) handled during the past 10 years, their outcome and utilization (in 200 words).

PIB-4637:

- Four tetraploid som genotype (PB009, PB010, PB011, and PB012) were developed through colchicines treatment and registered in NBPGR, ICAR, New Delhi under IC number *w.e.f.* IC-556923, IC-556924, IC-556925 & IC-556926 respectively. It is first reported in som (*Persea bombycina* Kost)
- Tetraploid accession, PB011 showed maximum leaf biomass than all other genotypes.
- Tetraploid accession, PB012 showed less larval period (23 days), maximum cocoon weight (6.70 g), shell weight (0.61 g) and ERR (88%) than other tetraploid and diploids som variety.
- Accession, PB012 showed higher crude protein (12.59%), less fiber (18.33%), higher soluble sugar (6.63%) and moisture (64.40%) content than other som varieties.
- Accession, PB012 is selected as superior som variety and recommended by Research Advisory Committee (RAC) of CMER&TI held on 13-14th March 2007 for commercial exploitation.

National Agricultural Technological Project (NATP): During NATP, Field Gene Bank of Muga and Eri silkworms host plants was established at Chenijan , Jorhat, Assam. Collected genetic resources were planted into field gene bank of Germplasm Conservation Centre (GCC) under Central Muga Eri Research and Training Institute, Lahdoigarh, Jorhat, Assam as follows.

Sl No	Name of the Species	Local Name	Nos. of genetic resources
1	*Persea bombycina* (King ex Hook .f.) Kost.	Som	51

2	*Litsaea polyantha* Blume	Soalu	30
3	*Litsaea salicifolia* Hook. F.	Digloti	16
4	*Litsaea cubeba* Pers.	Mejankari	2
5	*Litsaea nitida* Hook f.	Kathulua	2
6	*Ricinus communis* L.	Castor	72
7	*Heteropanex fragrans*	Kesseru	17
8	*Evodia flaxinifolia*	Payem	2
9	*Alianthus grandis,*	Barpat	2

PIB5838:

- Thirty nine (39) plus trees of som, *Persea bombycina* Kost. have been identified in Northeastern region of India (Assam, Nagaland, Meghalaya and Arunachal Pradesh) by comparison tree method which were collected and introduced into GPB from accession PB0013 to PB051.
- Thirty nine Som plus trees were registered in NBPGR, New Delhi under IC number from 73237 to IC 73275 respectively.
- Six som accessions *viz* PB-023, PB-028, PB-049, PB-029, PB-050 and PB-039 were screened as superior variety of Som for commercial exploitation and breeding programme.

PIB 5848:

- Two castor accessions *viz* AC –003, AC -004 have been screen as superior Castor variety for commercial exploitation in fields and utilization in breeding programme.

PART VII: DECLARATION/CERTIFICATION

It is certified that

a. The research work proposed in the project does not in any way duplicate the work already done or being carried out elsewhere on the subject.
b. The same project has not been submitted to any other agencies for financial support.
c. The emoluments for the manpower proposed are those admissible to persons of corresponding status employed in the institute/university or as per the Ministry of Science & Technology guidelines (Annexure-III).
d. Necessary provision for the project will be made in the institute in anticipation of the sanction of the same.
e. If the project involves the utilization of genetically engineered organism, it is agreed that we will ensure that an application will be submitted through our institutional bio safety committee and we will declare that while conducting experiments, the bio-safety guidelines of the Department of Biotechnology would be followed *in toto.*
f. If the project involves field trials/experiments/exchange of specimens etc. We will ensure that ethical clearances would be taken from the concerned ethical committees/competent authorities and the same would be conveyed to the Department of Biotechnology before implementing the project.
g. It is agreed by us that any research outcome or intellectual property right (s) on the invention (s) arising out of the project shall be taken in accordance with the instructions issued with the approval of the Ministry of Finance, Department of Expenditure as contained in annexure-V.
h. We agree to accept the terms and conditions as enclosed in Annexure-IV. The same is signed and enclosed.
i. The institute agrees that the equipment, the basic facilities and such other administrative facilities as per terms and conditions of the grant will be extended to investigators throughout the duration of the project.
j. The institute assumes to undertake the financial and other management responsibilities of the project.

1. Signature of Project Coordinator
(Applicable for inter-institutional Institute project only)

2. Signature of Executive Authority
with seal and date

3. Signature of Principal Investigator

4. Signature of Co- Investigator

Highlights of Referee's comments

Dr. T. K. Narayanaswarmy GKVK, Bangaluru	**Dr. A. K Chakravarty IIHS, Bangaluru**	**Dr. M. V. Santha Kumar Shivajee University Kohlapore**	**Dr. M.S. Rao IIHS, Bangaluru**	**Dr. S.K Datta AAU, Assam**
1. Procedure is Followed	Practical and useful	The evolved technology can be tested at stakeholders level.	It is very essential to target the crawlers	Project bears scientific merrits with quality.
2. The sturdy seems to be the first of it kind.	Standardised method.	Not only for sericulture but essential to Agriculture also.	Appropriate technology to target the early instar.	Replication should be increased.
3.Apropriate methodology	10 % increase in leaf yield is envisaged	Scientific merit is graded as 4.	Objective is acheivable	Local plants with insecticidal value may be tried. preparation
4. Objective is relevant to works	More income to farmers	Facility is available.	Newly hatched crawlers are monitor able with indicators.	Objective is achievable.
5. Low cost innovative study.	Not hazardous Technology .	Blocking of insect migration is appropriate	Not hazardous to environment.	Chemical are to be supported by data for eco friendly issue.
6. No environmental and ethical problem.	Suggested to create awareness.	PI is competent.	Facilities is sufficient for the project.	The proper data recording is necessary.
7. Budget is OK	No change in fund.	Strongly needed for JRF	Recommended as this project will address the problem	Simple experiment with no hazard
8.Recommended for funding	Recommended	Recommended	Recommended for funding.	.Recommended

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