

*A Routine Programme*

**BAR (RP)-021: Survey, surveillance and monitoring of  
silkworm diseases in seed and commercial crops in Eastern  
and North Eastern India**

**Duration: 3 years**

**APRIL, 2016 - MARCH, 2019**



**Dr.K.Trivedy, Director - CEA**

**Co-Ordinators:**

**Director, DOS, Govt. of West Bengal, Odisha, Jharkhand and Assam  
Scientist-D, NSSO, West Bengal, Odisha, Jharkhand and Assam**

**Principal Investigator:**

**Dr.S. Chakrabarty, Scientist-C – PI**

**Co-Investigators:**

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Dr.A.K.Varma, Sci-D

Shri Zakir Hossain, Sci-D

Shri D.Chakrabarty, Sci-D

Dr. P. Ghosh, Sci-D

Shri K.Rahul, Sci-B

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JRF-01

**Silkworm Pathology Section**

**Central Sericultural Research & Training Institute**

**[ISO 9001:2008 Certified]**

**Central Silk Board**

**Ministry of Textiles: Government of India**

**Berhampore, Murshidabad – 742 101**

## PROFORMA – I

### PROFORMA FOR SUBMISSION OF PROJECT PROPOSALS ON RESEARCH AND DEVELOPMENT, PROGRAMME SUPPORT

(To be filled by the applicant)

#### PART I: GENERAL INFORMATION

1.	Name of the Institute/ University/ Organisation submitting the Project Proposal	:	Central Sericultural Research & Training Institute, Central Silk Board, Ministry of Textiles, Govt. of India, Berhampore, Murshidabad, W.B.-742101, India.
2.	Status of the Institute(s)	:	Govt.
3.	Name and designation of the Executive Authority of the Institute/University forwarding the application	:	<b>Dr.K.Trivedy, Director</b>
4.	Project Title	:	Survey, surveillance and monitoring of silkworm disease in seed and commercial crops in eastern and north-eastern India (with RSRs, RECs, DOS and NSSO).
5.	Category of the Project	:	Research and development
6.	Specific area	:	Crop protection
7.	Duration	:	03 years (April,2016 – March, 2019)
8.	Total cost	:	51.50 lakh
9.	Is the project Single Institutional or Multiple-Institutional (S/M)	:	Multi Institutional
10.	If the project is multi-institutional, please furnish the following: Name of Project Co-ordinator Affiliation & Address	:	1. Director, Department of Sericulture, Govt. of West Bengal, Odisha and Assam. 2. Scientist-D, National Silkworm Seed Organization, Central Silk Board, West Bengal, Odisha and Assam.
11(a)	Project Summary	:	Crop loss due to incidence of silkworm diseases has been a regular feature of sericulture scenario and disease caused by various pathogens, viz., virus, bacteria, fungi and microsporidians, take a heavy toll of cocoon crops in every year. It is felt necessary that disease management at the commercial level is essential for strict vigil of disease out break to ensure crop success in Eastern and North Eastern India. In this project, it is proposed for conducting survey and surveillance in recommended commercial crops of Eastern and North Eastern (NE) India and suggest effective remedial measures 'on spot' to the farmers' to control the disease and forewarn the farmers' for taking preventive measures in ensuing commercial crop. In this project, it is also proposed for conducting microscopic examination of the larvae / pupae in



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12.25. Name: **Zakir Hossain**

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12.26. Name: **Dr (Mrs) Subhra Chanda**

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12.27 Name: Scientist-D , In Charge

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12.28. Name: **Sri Gopal Das**

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12.29 Name: **Dr.A.K.Verma**

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12.31Name: **Smt. C.Maji**

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17.38. Name:

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Number of Research projects being handled at present:

AND

Scientists/Officers of NSSO and DOS, of West Bengal, Odisha and Assam

12.39. No. of Projects being handled by each investigator at present: 01 each by CI

12.40. Junior Research Fellow: One



JRF participation will be the main scientific support to carry out the network project. The proposed work is voluminous and no other scientists are available as Co-Investigator in Silkworm Pathology Laboratory. Collection of larva / pupa/ moth sample from farmers houses, microscopic examination of the sample, centrifugation of sample, data entry, analysis etc. are involved. In addition, JRF working in this project will be imparted basic as well as advanced training in insect biology, which will form an effective human resource development for the country.

### **PART III: TECHNICAL DETAILS OF PROJECT**

#### **13. Introduction**

Disease management in insect rearing systems is the selection and use of appropriate techniques to suppress disease incidence to a tolerable level. The concept of a tolerable level reflects many complex and interacting factors that are technical, economical, epizootiological and managerial in nature. Disease management will be most successful if it employs diverse approaches. Losses from diseases are incurred in all silkworm rearing areas although the severity may vary. It is not rare for a total failure of cocoon silk yield to be fall because of silkworm diseases, consequently affecting the national plan for silkworm eggs and raw silk production and also reducing personal income. Thus it is clear that effective control of silkworm diseases is an important step in attaining high yield of good quality silkworm cocoons, increasing income and augmenting production. The occurrence and spread of silkworm diseases are closely related to the constitution of the larvae, pathogen load and environmental conditions. During silkworm rearing it is not possible to achieve control by following any single approach. What is needed is knowledge of the epidemiology of the most important diseases, so that different disease control measures directed against principal causes of various diseases may be integrated with rearing techniques in different seasons of different areas. Only comprehensive and integrated steps can result in prevention of silkworm diseases.

‘Prevention is must than cure’ is the present approach that should be adopted in integrated disease control. This means that one should go about actively preventing disease before it occurs, and it is only when preventive measures are in force that we can hope to effectively control the occurrence and spread the disease. Dependence on treatment after disease has appeared will always entail losses. In short, the fundamental basis of silkworm disease control is the constant implementation of the “prevention first” policy.

Besides, crop loss due to pebrine disease is uncertain. *Nosema bombycis* is a pathogen caused the disease in *B. mori*. The disease is spread mainly through transovarian transmission by environmental spore and secondarily contaminated through rearing appliances etc. by primary spores. Pasteur (1970) made a detail study on the growth and multiplication of pathogen and he is the pioneer scientist to detect the transmission of pebrine through the eggs i.e., transovarial transmission. Cross-infection with other microsporidia is reported from silkworms. However, pebrine disease in silkworm has been kept under control within a reasonable limit, but not been eradicated completely. About 36 % crop loss is attributed due to pebrine disease with occasional crop failure in India (Nataraju *et al.*, 2005). Besides, rearing of seven farmers’ residing in the villages, Roypur, Bhadrapur, Akalipur area of Birbhum district of West Bengal has been lost their Baisakhi commercial crop (April, 2012) due to pebrine disease. Silkworm rearing of other farmers located at Bosowa, Rampurhat, Nalhati, Bhadrapur and Muraroi of the same district was also lost due to pebrine disease during Aswina commercial crop, 12.

Now prevention seems to be the only effective way out to minimise crop losses due to pebrine diseases to check the transmission of disease and for successful cocoon crop production. For better prevention, we have to monitor the disease at the seed and commercial level.

### **13.1 Origin of proposal**

During the past two decades the field of Insect Pathology has been experienced marked advances in both its basic and applied aspects. In the field of sericulture, silkworm disease survey and surveillance is of paramount importance to monitor silkworm rearing and thereby ensure the harvest of a successful cocoon crop. Extensive information generated through silkworm disease survey and surveillance is the fountain head of all practical accomplishments towards silkworm disease management in the field. To this end, extensive and intensive survey programmes are conducted to identify the disease patterns in silkworm rearings with a target to evolve many practical technologies with primary emphasis being given to prevention. When silkworm rearing is done extensively and uninterruptedly, then there is accumulation of pathogens and this level gradually goes up mainly through the silkworm vector. The management of silkworm disease is more population than individual oriented primarily because of the economics involved. The principal strategy, thus, is the prevention of disease which has got global acceptance and this can successfully accomplished through survey and surveillance of silkworm disease.

Moreover, a number of attempts have been taken by the different Sericulture Institute to control the silkworm disease, however, loss due to silkworm diseases, particularly pebrine is still reported in some areas of Birbhum district of West Bengal may be due to prevalent of new strains of pathogens, which are becoming resistant in the present degraded scenario and silkworms are fail to combat the attack of pathogens. Therefore, it is the demand of this era to monitor the disease in the Govt farm and farmers' field to ensure disease free seeds to the farmers' of West Bengal to sustain the sericulture. As per the decision taken in the Crop Schedule Meeting held on 03.08.12 at this Institute, it was felt necessary that Disease Monitoring at the parental and commercial level is essential for strict vigil of disease out break and to ensure supply of pebrine free seeds to the farmers of West Bengal. Keeping in view of this, district wise committee had been constituted comprising of members from DOT(Seri), ZSSO, Malda and CSR&TI, Berhampore to visit Seed Farms and Commercial areas under DOT(Seri) and ZSSO, Malda located in ten districts i.e., Murshidabad, Birbhum, Nadia, Malda, Uttar Dinajpur, Dakshin Dinajpur, Jalpaiguri, Darjeeling (Plain and Hill), Coochbehar and Midnapore for conducting microscopic examination of the larvae / Pupae in seed crops and 5 recommended Commercial Crops of West Bengal. The programme is running satisfactorily for last three years i.e, 2012-15. Now, the Chairman of the 43<sup>rd</sup> Reseach Council meeting held at this Institute on Dec, 8-9, 2015 and it is desired to continue the same programme as a mega project for 3 years i.e., 2016-19 comprising the members from RECs, RSRSs, DOT (Seri), NSSO and CSR&TI, Berhampore for Eastern and North Eastern region. The designated Team Leaders are required to undertake the project as per schedule. The respective district Officers, DOT (Seri) and Scientists of NSSO will monitor the programme.

### **13.2 Definition of the problem**

When silkworm rearing is done extensively and uninterruptedly, then there is an accumulation of pathogens and loss due to attack of various silkworm diseases may be due to prevalent of pathogens, which are becoming resistant in the present degraded scenario or pathogen is overlooked at the time of microscopic examination and multiply at the farmers' field. Therefore, it is felt necessary for survey and surveillance of the disease for strict vigil of disease out break to ensure successful of crop through survey and surveillance of the silkworm disease in eastern and north-eastern region.

Loss due to silkworm diseases, particularly pebrine is still reported in some areas of traditional districts of West Bengal for last three years i.e., 2012-15, may be due to prevalent of pathogens, which are becoming resistant in the present degraded scenario or pathogen is overlooked at the time of microscopic examination and multiply at the farmers' field. It is felt necessary that disease monitoring at the parental and commercial level for strict vigil of disease

out break, especially pebrine and to ensure supply of pebrine free seeds to the farmers' of West Bengal. Therefore, it is the demand of this era to monitor the disease in the Govt. farms and farmers' field to ensure disease free seeds to the farmers' of West Bengal to sustain the sericulture.

### **13.3 Current status of research and development in the subject (both international and national status)**

International status

National status

Mulberry silkworm, *Bombyx mori* is susceptible to different diseases primarily caused by Microsporidia, Virus, Bacteria and Fungi. Farmers frequently encounter crop losses due to infection by these pathogens. Various preventive measures are followed to protect silkworm from diseases during silkworm rearing.

A total 2104 farmers samples (1455 for seed and 649 for commercial) have been examined located in 160 villages and DOS farms during parental (P3/P2/P1) and commercial rearing in 09 (nine) sericulture districts i.e., Murshidabad, Birbhum, Nadia, Malda, Uttar Dinajpur, Dakshin Dinajpur, Jalpaiguri, Darjeeling (Plain and Hill), Coochbehar and Midnapore of West Bengal for **2013-14**. All the diseases have been recorded very less (Pebrine- 0.6 %, Grasserie- 3.1%, Flacherie- 1.0%, Muscardine- 3.3% and Gattine- 0.6%) though pool data analysis of seed samples indicated that all the diseases have been recorded very less (Pebrine- 0.1 %, Grasserie- 1.7 %, Flacherie- 0.7% and Muscardine- 0.6%) and pool data analysis of commercial samples indicated that all the diseases have been recorded also very less (Pebrine- 1.3 %, Grasserie- 5.7%, Flacherie- 1.6%, Muscardine- 8.4% and Gattine- 1.8 %). All the diseases have been under control except Grasserie (5.7%) for commercial samples. But this time recording of 'pebrine' in both seed (0.1%) and commercial samples (1.3%) is an important observation of the programme.

A total 1993 samples (885 for seed and 1108 for commercial) have been examined of 234 villages / DOS farms during parental (P3/P2/P1) and commercial rearing during **2014 - 15**. The incidence of 'Pebrine' have been recorded in the range of 0.03 - 3.0 % during Bhaduri (P2, P1), Aswina (P1), Aghrayani (P1), Falguni (P1) and Baisakahi (P2, P1) seed crops. Detail analysis revealed that 'Grasserie' (10.2%) and 'Muscardine' (15.2%) diseases are also prevalent during Bhaduri and Falguni commercial crop respectively. Grasserie (4.8%) and Gattine (2.4%) diseases have also been recorded during Falguni commercial crop. But recording of 'pebrine' in both seed (~3.0%) and commercial samples (~0.06%) is an important observation of the programme.

A total 613 sample (428 for seed and 185 for commercial) have been examined from farmers of 32 villages and 21 NSSO / DOT (Seri) farms during parental and commercial rearing in sericulture districts of West Bengal in different seed and commercial crop during **2015-16** and around 1.9% pebrine.8.9% Grasserie, 4.1% Flacherie have been recorded.

### **13.4 The relevance and expected outcome of the proposed study**

Strict vigils of disease out break at seed and commercial crops of West Bengal and suggest effective remedial measures on spot to the farmers'/farms' to control the diseases.

## **14. Work Plan**

### **14.1. Selection of seed and commercial areas**

Scientists will visit the villages of three traditional districts for conducting supervision of the larvae / pupae in recommended commercial crops of in eastern and north eastern India. A team may be formed with DOS, NSSO, West Bengal, Odisha and Assam and CSR&TI, Berhampore. District wise committee will be constituted comprising of members from DOT (Seri), NSSO, West Bengal, Odisha and Assam and CSR&TI, Berhampore to visit Seed Farms and Commercial areas under DOT (Seri) and NSSO located in ten districts i.e., Murshidabad, Birbhum, Nadia, Malda, Uttar Dinajpur, Dakshin Dinajpur, Jalpaiguri, Darjeeling (Plain), Coochbehar and Midnapore of West Bengal; three districts of Assam i.e., Jorhat, Darrang and Udaigiri ; two districts of Koraput and Raygada and three districts of

Jharkhand, Baridis, Mahadebhagri, Makra for conducting microscopic examination of the larvae / Pupae in seed crops and recommended Commercial Crops of West Bengal, Odisha, Assam and Jharkhand.

- No. of farmers / sample involved per crop at each implementing unit: 10
- Crops to be visited: As per crop schedule as listed below.

#### 14.2.1 Committee members for West Bengal:

#	District	Committee members
1	<b>Murshidabad</b>	1) Dr.Sandip Kumar Dutta, Scientist-D - <b>Team Leader</b> 2) Debashis Chakrabarty, Sci-C CSR&TI, Berhampore – Member 3) Dr.A.K.Saha, Scientist-D, SSPC, Berhampore - Member 4) Sri Swapan Kr. Maity, D.I., DOT(Seri), Murshidabad,W.B. – Member
2	<b>Birbhum</b>	1) Dr.(Mrs) Subhra Chanda,Sci-D, - <b>Team Leader</b> 2) Scientist-D, SSPC, Kalitha, Birbhum - Member 3) Sri Swapan Mallik, E.O., DOT(Seri), Nalhati, Birbhum - Member
3	<b>Nadia</b>	1) Shri Gopal Das, Scientist-C, REC,Karimpur - <b>Team Leader</b> 2) Scientist-D, BSF, Banguria, Nadia - Member 3) Sri Jamal Sk E.O., DOT(Seri), Nadia – Member
4	<b>Malda</b>	1) Dr.A.K.Verma, Scientist-D, CSR&TI,Berhampore - <b>Team Leader</b> 2) Scientist-D, ZSSO, Malda – Member 3) Sri Santosh Kumar, E.O., DOT(Seri), Malda – Member
5	<b>U/ Dinajpur</b>	1) Dr. Dipesh Pandit , Scientist-D,– <b>Team Leader</b> 2) Dr.S.Ghosh,Scientist-D,SSPC, Raiganj – Member 3) Sri Manas Kr Gupta, EOS,Hemtabad Seri Complex Unit- Member
6	<b>D/ Dinajpur</b>	1) Dr. Dipesh Pandit , Scientist-D - <b>Team Leader</b> 2) Dr.M.K.Ghosh,Scientist-D,SSPC,D.B.Pur- Member 3) Sri Ajoy Ghosh, E.O., DOT(Seri), Dakshin Dinajpur - Member
7	<b>Jalpaiguri</b>	1) Sri S.Chatterjee, Scientist-D, RSRS Kalimpong - <b>Team Leader</b> 2) Smt R.Bhutia, Sci-D, BSF, Ambarifalakata, Siliguri - Member 3) Sri Probodh Kumar Sahu, D.O., DOT (Seri), Jalpaiguri - Member
8	<b>Coochbehar</b>	1) Sri S.Chatterjee,Scientist-D, RSRS Kalimpong – <b>Team Leader</b> 2) Smt R.Bhutia, Sci-D, ,BSF,Ambarifalakata,Siliguri- Member 3) Sri Subhasis Mandal,E.O., E.O.,DOT(Seri), Coochbehar - Member
9	<b>Darjeeling (Plain)</b>	1) Mrs C.Majee,Scientist-D, RSRS, Kalimpong - <b>Team Leader</b> 2) Smt R.Bhutia, Sci-D, BSF,ZSSO,Ambarifalakata,Siliguri- Member 3) Manab Bhoumik, E.O., DOT(Seri),Matigara Sericulture Complex 4) Sri Ganesh Besta, E.O., DOT(Seri), Darjeeling Plain- Member
10	<b>Midnapore</b>	1) Z.Hossain, Scientist-C,CSR&TI, Berhampore- <b>Team Leader</b> 2) Dr.S.K.Majumdar, Scientist-D, BSF, Dhubulia- Member 3) Smt Manjushree Debta, E.O.,DOT(Seri), Midnapur- Member

#### 14.2.2 Crop schedule and tentative date of brushing / visit for West Bengal

#	Crops	Tentative date of brushing	Tentative date of visit	District
1.	P2 Shravani,	26-30 Mar	3rd week April	Malda, Jalpaiguri, Uttar and D/Dinajpur, Nadia
2	Baisakhi Comm.	28-30 March	4 <sup>th</sup> week April	All districts
3	P1 Jaistha,	8-10 April	4 <sup>th</sup> week April	Murshidabad & Birbhum
4	P3 Bhaduri,	7-12 April	4 <sup>th</sup> Week April	Malda, Jalpaiguri, Uttar and D/Dinajpur,
5	Spring Crop	20-22 April	2 <sup>nd</sup> Week May	Jalpaiguri and Cooch Behar
6	P1 Shravani,	7-10, May	4 <sup>th</sup> Week May	Malda, Jalpaiguri, Uttar and D/Dinajpur, Nadia
7	P3 Aswina	1-3 May	1st week June	Murshidabad, Birbhum & Nadia
8	P2 Bhaduri,	15-21 May	1 <sup>st</sup> week June	Malda, Jalpaiguri, Uttar and D/Dinajpur,
9	Jaistha comm.	20-22 May	3 <sup>rd</sup> week June	Murshidabad & Birbhum
10	P2 Aswina	7-9 June	1 <sup>st</sup> week July	Murshidabad, Birbhum & Nadia
11	P1 Bhaduri,	21-23 June	1 <sup>st</sup> week of July	Malda, Jalpaiguri, Uttar and D/Dinajpur,
12	Shravani Comm.	20-23 June	1st week July	Malda, Jalpaiguri, Uttar and D/Dinajpur, Nadia
13	Summer crop	20-22 June	2nd week Jul	Jalpaiguri and Cooch Behar
14	P3 Aghrayani	28 June- 5 July	2 <sup>nd</sup> week July	All districts
15	P1 Aswina	14-18 July	3rd week Aug	Murshidabad, Birbhum & Nadia
16	Bhaduri Comm.	4-6 Aug	4 <sup>th</sup> week Aug	Malda, Jalpaiguri, Uttar and D/Dinajpur,
17	P2 Aghrayani	7-13 Aug	4 <sup>th</sup> week Aug	All districts
18	Autumn crop	20-25 Aug	3 <sup>rd</sup> week Sep	Jalpaiguri and Cooch Behar
19	P3 Falguni,	6-12 Sep	4 <sup>th</sup> week Sep,	All the districts except Malda, Jalpaiguri, Uttar and D/Dinajpur,
20	P3 Chaitra	15-21 Sep	1 <sup>st</sup> week Oct	Malda, Jalpaiguri, Uttar and D/Dinajpur,
21	Aswina Comm.	23-25 Aug	4 <sup>th</sup> week Sep	Murshidabad, Birbhum & Nadia
22	P1 Aghrayani	16-18 Sep	2nd week Oct,	All districts
23	P2 Falguni	16-24 Oct	2nd week Nov	All the districts except Malda, Jalpaiguri, Uttar and D/Dinajpur,
24	P2 Chaitra	25 Oct – 3 Nov	3 <sup>rd</sup> week Nov	Malda, Jalpaiguri, Uttar and D/Dinajpur,
25	P3 Baisakhi,	2-6 Nov	4th week Nov	All districts
26	Aghrayani comm.	31 Oct – 5 Nov	4th week Nov 1st week Dec	All districts
27	P1 Falguni	15-20 Nov	2 <sup>nd</sup> Week Dec	Jalpaiguri and Cooch Behar
28	P1 Falguni,	2-4 Dec	4th week Dec	All the districts except Malda, Jalpaiguri, Uttar and D/Dinajpur,
29	P1 Chaitra	11-14 Dec	1 <sup>st</sup> week Jan	Malda, Jalpaiguri, Uttar and D/Dinajpur,
30	P2 Baisakhi,	20-22 Dec	4th week Jan	All districts
31	P3 Jaistha,	25-29 Dec	3rd Week Jan	Murshidabad & Birbhum
32	Falguni Comm.	28-30 Jan	4 <sup>th</sup> week Feb	All the districts except Malda, Jalpaiguri, Uttar and D/Dinajpur,
33	Chaitra Comm.	6-9 Feb	1 <sup>st</sup> week Mar	Malda, Jalpaiguri, Uttar and D/Dinajpur,
34	P3 Shravani,	10-14 Feb	1 <sup>st</sup> week Mar	Malda, Jalpaiguri, Uttar and D/Dinajpur, Nadia
35	P2 Jaistha,	11-13 Feb	4 <sup>th</sup> week Mar	Murshidabad & Birbhum
36	P1 Baisakhi,	14-16 Feb	4 <sup>th</sup> week Mar	All districts

### 14.3.1 Crop schedule and tentative date of brushing / visit for Odisha

#	Crops	Tentative date of brushing	Tentative date of visit	Districts
1	August crop	20 August	2nd week of Sep.	Koraput, Rayagada
2	October crop	20 October	2nd week of Nov.	Koraput, Rayagada
3	February crop.	20 February	2 <sup>nd</sup> week of Mar	Koraput, Rayagada
4	May crop.	20 May	2 <sup>nd</sup> week of June	Koraput, Rayagada

### 14.3.2 Committee members for Odisha

#	District	Committee members
1	Koraput	1) Sri N.R.Rao Sci-C, RSRS, Koraput, - <b>Team Leader</b> 2) E.O., DOS, Koraput, Assam 3) In Charge, NSSO, Koraput
2	Raygada	1) Sri S.K.Misro, Sci-C, RSRS, Koraput, - <b>Team Leader</b> 2) Sri Das, EO, Raygada district 3) In Charge NSSO, Raygada

### 14.4.1 Crop schedule and tentative date of brushing / visit for Jharkhand

#	Crops	Tentative date of brushing	Tentative date of visit	Area
1	Aug - Sep	1 <sup>st</sup> week Aug	4 <sup>th</sup> week Aug	Varna block (Baridis, Mahadebchagri, Makra)
2	Oct-Nov	1 <sup>st</sup> week Oct	4 <sup>th</sup> week Oct	Varna block (Baridis, Mahadebchagri, Makra)
3	Feb-Mar	4 <sup>th</sup> week Feb	3 <sup>rd</sup> week Mar	Varna block (Baridis, Mahadebchagri, Makra)

### 14.4.2 Committee members for Jharkhand

#	District	Committee members
1	Baridis	4) Sri Alam Sci-C, RSRS, Ranchi, - <b>Team Leader</b> 5) E.O, DOS, Baridis, Jharkhand 6) In Charge NSSO, Baridis, Jharkhand
2	Mahadeb giri	4) Sci-C, Mahadebgiri - <b>Team Leader</b> 5) E.O, DOS, Mahadebgiri district 6) In Charge NSSO, Mahadebgiri
3.	Kakra	7) Sci-C, Kakra, - <b>Team Leader</b> 8) E.O, DOS, Kakra, Jharkhand 9) In Charge NSSO, Kakra

#### 14.5.1 Crop schedule and tentative date of brushing / visit for Kalimpong

#	Seed Crops	Tentative date of brushing	Tentative date of visit	Area
1.	Spring crop	22-24 <sup>th</sup> April	3 <sup>rd</sup> week May	Mahalaldara, Bhalukhop, Sangsay
2	Summer crop	22-24 <sup>th</sup> June	3 <sup>rd</sup> week July	Mahalaldara, Bhalukhop, Sangsay
3	Autumn crop	22-24 <sup>th</sup> Aug	3 <sup>rd</sup> week September	Mahalaldara, Bhalukhop, Sangsay

#### 14.5.2 Committee members for Kalimpong

#	District	Committee members
1	Mahalaldara,	1) Sri S.Chatterjee , RSRS, Kalimpong, - <b>Team Leader</b> 2) E.O,DOS, Mahalaldara 3) In Charge NSSO, Mahalaldara
2	Bhalukhop,	10) Sri S.Chatterjee , RSRS, Bhalukhop, - <b>Team Leader</b> 11) E.O,DOS, Bhalukhop 12) In Charge NSSO, Bhalukhop
3.	Sangsay	13) Sri S.Chatterjee , RSRS, Kalimpong, - <b>Team Leader</b> 14) E.O,DOS, Sangsay 15) In Charge NSSO, Sangsay

#### 14.6.1 Crop schedule and tentative date of brushing / visit for Assam

#	SCHEDULE OF ACTIVITIES	Starting	Ending
1	Survey of the silkworm disease and data collection for Spring crop	4 <sup>th</sup> week Mar	April
2	Survey of the silkworm disease and data collection for Summer crop	May	June
3	Data compilation of Disease Survey Report from nested units	July	Aug
4	Survey of the silkworm disease and data collection for Autumn crop	Sep	Oct
6	Data compilation of Disease Survey Report from nested units	Nov	Jan
7	Pre crop inspection and submit annual / final report	Feb	Mar

## 14.6.2 Committee members for Assam

#	District	Committee members
1	Jorhat	1) Sri B.K.Basumatary Sci-C, REC Mangaldoi, - <b>Team Leader</b> 2) Sri K.S.Bordoloi,E.O,DOS,Jorhat,Assam 3) In Charge NSSO, Jorhat
2	Darrang	1. Sri B.K.Basumatary Sci-C, REC Mangaldoi, - <b>Team Leader</b> 2. Sri Das,EO,Darrang district 3. In Charge NSSO,Darrang
3	Udaigiri	1) Smt M.Pamehgam Sci-C, RSRS,Jorhat, - <b>Team Leader</b> 2) Sri Mukul Deka,EO,Udaigiri district 3) In Charge NSSO,Udaigiri

## 14.7 Methodology

### **STANDARD METHODOLOGY OF COLLECTION SAMPLE**

#### (I) Selection of villages and farmers

1. No. of villages to be surveyed: 03/district.
2. No. of farmers to be surveyed / villages: 03 (i.e. A total of 9 farmers from 3 villages).
3. Farmers having the capacity to rear 100-200 dfls with minimum rearing facilities to be surveyed.

#### (II) Sample size and frequency of survey

4. A minimum of 500 larval populations will be collected randomly from top, middle and bottom positioned trays.
5. Survey will be conducted once during the rearing period preferably during the spinning time and 2<sup>nd</sup> time visit / 'awareness programme' may be conducted, if any disease out break is noticed.

#### (III) Disease examination and collection of data

6. For examination, morphological symptoms and larval test will be considered.
7. Larval mortality will be recorded from rearing tray for each disease.
8. The maximum and minimum temperature, maximum and minimum relative humidity (RH %) of rearing room and total rainfall (During the rearing period, i.e. from brushing to spinning stage) day wise will be collected from the farmers, if available. Information on number of cloudy days (during the rearing period) will also be collected.
9. Yield per 100 dfls will be collected from the farmers, if available to justify the disease incidence / crop loss.
10. All above the data for previous crop/seasons should also be collected, if available to compare the result.

#### (IV) Management

11. Maintenance of the hygienic condition both inside and surrounding the rearing house, care in handling and disposal of diseased larvae. Besides, noting the thickness of the rearing bed will also be properly studied.

#### (IV) Submission of report

12. Please submit the report immediately soon after completion of the crop.
13. Report will contain all the data in standard format.
14. The entire nested units submit the report through their respective RSRS.
15. RSRSs will collect the report from RECs and send the consolidated report to the main Institute immediately after verifying the data.



## STANDARD METHODOLOGY FOR DETECTION OF PEBRINE DISEASES

### 1. Pebrine disease :

#### Improved method of mother moth examination

Under the group moth examination method, moths are tested in groups of 20

- Place 20 moths in a mixie cup
- Add 80ml of 0.6% K<sub>2</sub>CO<sub>3</sub> solution
- Homogenise for 1-2 m, at medium speed
- Transfer the homogenate into a beaker or tumbler, preferably of plastic
- Allow the homogenate to settle for 3-5m, so that un-macerated tissue and debris get separated and float above
- Filter the bottom liquid carefully, through thick layer of clean muslin cloth or a thin layer of absorbent cotton
- Centrifuge the filtrate for 3m, at 3000 rpm
- Decant the supernatant solution
- Disperse the sediment in a few drops of 2% KOH solution over a vortex mixer or by using a glass rod
- Examine two smears from each samples at 600x magnification under a microscope (phase contrast objectives)
- Examination to be done by two personnel for cross checking
- Record the intensity of infection, if any, based on intensity of spores/ field as indicated below:

Table 1: Grading of intensity of pebrine infection based on number of spores/ field

±	1-3 spores
1+	4-10 spores
2+	11-30 spores
3+	31-100 spores
4+	101-300 spores
α	>300 spores

The examination concerning nucleus (P2) or reproductive (P1) seed is conducted with each moth by means of microscope. The eggs laid by the mother, that is free from the pebrine spores are qualified, but those from infested mother moth are disqualified.

The examination of commercial silkworm eggs is not conducted with all their mother moths, but with a certain portion of the mother moths, i.e., picking up sample moths from rearing lot according to Table 2. If there are no infected moths, all the eggs concerned are qualified. But if there are any taint, the second examination is carried out according to table 3. In either the first or second examination, if the number of infected moths exceeds a fixed number, the eggs are disqualified.

Table2: The primary examination for pebrine with mother moths

Number of moths in a rearing lot	Number of samples to be examined	Number of moths found infected
390 moths or below	Whole	01
391-500	390	01
501-600	450	01
601-800	510	01
801-1000	590	01
1001-2000	750	02
2001-3000	870	03
3001-4000	900	04
4001-6000	960	05
6001-10000	990	06
10001-30000	1020	06
30001 or above	1050	06

Table3: The secondary examination for pebrine with mother moths

Number of moths in a rearing lot	Number of samples to be examined	Number of moths found pebrine infected
1001-2000	210	02
2001-3000	480	03
3001-4000	840	04
4001-6000	1140	05
6001-10000	1530	06
10001-30000	1680	06
30001 or above	1940	06

### Improved methods of pebrine diagnosis in developmental stages of silkworm

The practices adopted for prevention of pebrine have not always been fool proof and it has lead to sporadic outbreak of this disease in India occasionally. Mother moth examination and strict monitoring of seed crop, besides disinfections are the most essential strategies to prevent occurrence of this disease in the field. Seed monitoring involves regular and periodic examination of sample eggs, larvae, pupae, litter etc., during the progress of a crop, which facilitates timely detection of the disease of a crop for taking up appropriate prophylactic measure. Specific procedures have already been standardized and advocated to carryout monitoring of pebrine in seed crop, which involve examination of egg shells, larvae, pupae, dust and silkworm litter. These procedures have been further modified by incorporating certain specific improvements to increase the efficiency of the techniques.

#### Pebrine inspection in silkworm eggs

The layings infected with *Nosema bombycis* when exposed to moderately higher temperature of  $32 \pm 1^\circ\text{C}$  for a period of 48 h significantly enhances sporulation of the pathogen resulting in increased spore production facilitating more effective diagnosis of the disease in such eggs.

##### Procedure

- Collect sample eggs from a batch on the 2<sup>nd</sup> day of oviposition
- Incubate the sample eggs  $32 \pm 1^\circ\text{C}$  and 60-70% RH for 48 h in an incubator
- Transfer the sample eggs to room temperature preferably  $25 \pm 1^\circ\text{C}$
- Conduct microscopic examination of the eggs on any of the succeeding days before hatching, by following the standard procedure

#### Pebrine inspection in larval stage

The rate of sporulation of *Nosema bombycis* in the body of silkworm significantly increases in relation to starvation stress. Starving of perbine infected larvae for 48 h has been observed to improve the chances of detection significantly. This is observed to be particularly useful under conditions of low infection.

##### Procedure

- Collect weak/ lethargic/ suspected to be diseased larvae
- Starve the larvae for 48 h and conduct examination as per standard procedure

#### Pebrine inspection in pupal stage

Sporulation of *Nosema bombycis* has been observed to increase in the infected pupae when they are preserved at moderately higher temperature of  $32 \pm 1^\circ\text{C}$  and 60-70% RH.

##### Procedure

- Preserve sample pupae (from 5<sup>th</sup> to 7<sup>th</sup> day at  $32 \pm 1^\circ\text{C}$  and 60-70% RH in an incubator for 48-72h and conduct examination after the stipulated period as per standard procedure

## Delayed mother moth examination

Microscopic examination of mother moths is the only procedure, which is practically feasible and reliable for diagnosis of pebrine and production of disease free quality layings.

The effectiveness of this method however, depends not only on the technical procedures employed for extracting and concentrating the spores but also, and even more on the intensity of the spores in the body tissues of the moth itself. Studies revealed that the rate of pathogen replication and thereby the concentration of pebrine spores in the infected moths increase subsequently, if they are preserved at ambient room temperature preferably 25-30°C for a period of 3-4 days after oviposition. This is due to the fact that the microsporidian development and sporulation is directly correlated with the nutritional status of the host and therefore most of the intermediary stages of the pathogen tend to develop into spore. This results in production of increased number of spores in the body of the older moths. This facilitates easy and more accurate detection of pebrine in such moths than in those immediately after oviposition.

### *Merits of delayed mother moth test*

- Due to enhanced sporulation in older moths, easy and more effective detection of pebrine is possible
- Even under low intensity of levels of infection, pebrine can be detected by this method and is therefore more reliable
- This technique will be particularly useful at the levels of basic seed production up to P1 seed

## Identification of intermediary stages of *Nosema bombycis*

The microsporidian life cycle has two distinct sequences, Schizogony, the vegetative phase and sporogony, the production of spores. The spores germinate under alkaline conditions inside the gut and infect the gut epithelium. The infective agent or sporoplasm from the spore after entering the target cell grow and forms schizont. The schizonts divide repeatedly to form daughter schizonts. They then transform into sporonts, which later develop into sporoblasts. The sporoblasts develop into mature spores. *Nosema bombycis* during the life cycle produces two types of spores- a smaller pyriform type (with short polar tube) and a typically oval, refractive (with long polar tube) type of spore. The pyriform spores are produced till the host has sufficient nutrition in the body and are responsible for spread of infection within a single larva.

The different intermediary stages of *Nosema bombycis* can be detected in the mid gut tissue smear. The simple staining procedure of the mid gut tissue smear involves the following steps:

- Dissect out a portion of mid gut from a larva
- Make a smear of the tissue on a clear glass slide using another slide
- Air dry the smear
- Fix the smear in methanol for 10 m
- Stain with Giemsa's staining solution (1:9 dilution) by flooding the slide with the stain for 20 m
- Wash the slide in running tap water for 1 m
- Place a cover slip and observe under oil immersion objective at 1500x
- Intermediary stages of the *Nosema bombycis*, viz., schizont, sporont, sporoblast and spores can be identified by observing their characteristic feature

Stage	Characteristics
Schizont	Characterized by compact, darkly stained nucleus and cytoplasm
Sporont	Elongated, bi-nucleated cells with lightly stained granulated rough nuclei and cytoplasm with a refractile spot
Sporoblast	Phase-I sporoblasts are characterized by darkly stained apical body and phase-II sporoblasts are lightly stained and appear as more hyaline oval bodies

### Distinguishing characters of pebrine spores and other microscopic objects

- Pebrine spores are oval/ ovo-cylindrical, highly refractive and exhibit Brownian movement
- Spores of *Bacillus thuringiensis* are oval, smaller than spores of *Nosema bombycis* and do not exhibit Brownian movement
- Polyhedra are hexagonal/ pentagonal/ tetragonal and less refractive
- Conidia of White Muscardine are spherical, less refractive while the conidia of Green Muscardine are oval with one end pointed and less refractive
- Fat bodies are spherical, floats on the surface and do not dissolve in alkali
- General measures for prevention of pebrine
- Practice disinfection of silkworm rearing house, surroundings, appliances, silkworm seed production unit and silkworm eggs
- Practice hygienic measures during silkworm rearing as well as silkworm egg production
- Employ the measures for destruction of diseased silkworm eggs/ cocoons/ faeces
- Monitor the seed crops and commercial crops for pebrine disease throughout the rearing period
- Control alternate hosts of *Nosema* insect pests in and around mulberry plantation
- Dust Labex as per schedule and quantity

## 2. Bacteria and bacterial diseases of silkworm

Bacteria are the etiological agents of 'flacherie' disease in silkworm were first reported by Pasteur (1870). Through light microscope we can study the morphology of bacteria, i.e., size, shape, arrangement of cells and structure. Rod shaped bacillus and sphere shaped coccus are the two major groups of bacteria. These rod and sphere shaped cells are also occur in chain (*Streptococcus* & *Strepto bacillus*) and in bunch (*Staphylococcus*). The bacteria are both sporulating and non sporulating types. The disease caused by the bacteria in silkworm is called flacherie and are broadly classified into two (1) those are restricted to the intestine and (2) those that enter into the hemolymph too (Septicemia). In bacterial disease, gut juice or hemolymph can be tested under light microscope for identification of bacteria.

#	Disease	Bacteria	Shape	Size
01	Black Thorax Septicemia	<i>Bacillus sp.</i> Diplo bacillus	Rod Two rod shaped bacteria	Bacillus: Length= 2-5.8 $\mu$ Breadth= 0.6-1.2 $\mu$
02	Red Septicemia	<i>Serratia marcescens</i>	Rod	
03	Gattine	<i>Staphylococcus vitulinus</i>	Bunch of sphere shaped cells	
04	Sotto	<i>Bacillus thuringiensis</i>	Chain of rod shaped cells	Coccus: Diameter = 0.6-1.4 $\mu$
05	Bacterial gastroenteric disease	<i>Streptococcus sp.</i> Diplo coccus	More than two sphere shaped cells in a chain  Two sphere shaped bacteria	

## 3. Virus and viral disease of Silkworm

The virus exists both inside and outside the polyhedra, the former being called polyhedral virus (Nuclear polyhedrosis virus and Cytoplasmic polyhedrosis virus) and the latter free virus (Densonucleosis virus and Infectious flacherie virus). The grasserie and cytoplasmic polyhedrosis are caused by polyhedral virus and we can identify the disease with the help of light microscope by seeing the polyhedral bodies in the tissue homogenate or hemolymph.

### Procedure

Separate the infected tissue (preferably mid gut) from the larvae and grind with the help of a mortar and pestle by adding water. Filter the homogenate through cheesecloth or absorbent cotton and centrifuge the filtrate at 3000 rpm for 3-4 minutes. Decant the supernatant and suspend the sediment in

fresh water and mix properly using a glass rod or a cyclomixer. Take one drop of the sample on a clean slide and put one square cover slip and examine under phase contrast microscope (600 x). Examine four corners and middle of the slide and cross-check it. Polyhedral bodies can be identified by examining the hemolymph of the suspected larvae. Result: Presence of hexagonal/ pentagonal/ tetragonal bodies (polyhedra) reveals Grasserie infection.

#### 4. Fungi and fungal diseases of silkworm

Fungal disease is caused by pathogenic fungi. Among the various fungal diseases of silkworm, White Muscardine, Green Muscardine and Aspergillosis are very common. White Muscardine and Green Muscardine infect the late age larvae, but Aspergillosis infects the young stage larvae. Generally the conidia are globular or oval, colourless and light green under the microscope.

##### *Procedure*

Make a fresh smear of the hemolymph from the suspected larvae/ pupae and observe under light microscope (600 x magnifications). Result: Presence of short hypahe or vegetative hyphae.

#### 14.8.1 TIME SCHEDULE OF ACTIVITIES / MILESTONES FOR WEST BENGAL

#	Crops	Tentative date of visit*	#	Crops	Tentative date of visit*
1.	P2 Shravani,	3rd week April	19	P3 Chaitra	1 <sup>st</sup> week Oct
2	Baisakhi comm.	4 <sup>th</sup> week April	20	Autumn crop	3 <sup>rd</sup> week Sep
3	P1 Jaistha,	4 <sup>th</sup> week April	21	Aswina Comm.	4 <sup>th</sup> week Sep
4	P3 Bhaduri,	4 <sup>th</sup> Week April	22	P1 Aghrayani	2nd week Oct
5	Spring crop,	2 <sup>nd</sup> Week May	23	P2 Falguni	2nd week Nov
6	P1 Shravani,	4 <sup>th</sup> Week May	24	P2 Chaitra	3 <sup>rd</sup> week Nov
7	P3 Aswina	1st week June	25	P3 Baisakhi,	4th week Nov
8	P2 Bhaduri,	1 <sup>st</sup> week June	26	Aghrayani comm.	4th week Nov 1st week Dec
9	Jaistha comm.	3 <sup>rd</sup> week June	27	P1 Falguni,	2nd / 4th week Dec
10	P2 Aswina	1 <sup>st</sup> week July	28	P1 Chaitra	1 <sup>st</sup> week Jan
11	P1 Bhaduri,	1 <sup>st</sup> week of July	29	P2 Baisakhi,	4th week Jan
12	Shravani Comm.	1st week July	30	P3 Jaistha,	3rd Week Jan
13	Summer crop	2 <sup>nd</sup> Week July	31	Falguni Comm.	4 <sup>th</sup> week Feb
14	P3 Aghrayani	2 <sup>nd</sup> week July	32	Chaitra Comm.	1 <sup>st</sup> week Mar
15	P1 Aswina	3rd week Aug	33	P3 Shravani,	1 <sup>st</sup> week March
16	Bhaduri Comm.	4 <sup>th</sup> week Aug	34	P2 Jaistha,	4 <sup>th</sup> week Mar
17	P2 Aghrayani	4 <sup>th</sup> week Aug	35	P1 Baisakhi,	4 <sup>th</sup> week Mar
18	P3 Falguni,	4 <sup>th</sup> week Sep		*Schedule date of visit may vary depending upon the date of brushing	

#### 14.8.2. TIME SCHEDULE OF ACTIVITIES /MILESTONES FOR ODISHA

#	SCHEDULE OF ACTIVITIES	Starting	Ending
1	Data compilation of Disease Survey Report from nested units	April	3 <sup>rd</sup> week May
2	Survey of the silkworm disease and data collection for May crop.	4 <sup>th</sup> week May	4 <sup>th</sup> week June
3	Data compilation of Disease Survey Report from nested units	1 <sup>st</sup> week July	4 <sup>th</sup> week July
4	Survey of the silkworm disease and data collection for August crop	August	Sep
5	Data compilation of Disease Survey Report from nested units	1 <sup>st</sup> week Oct	3 <sup>rd</sup> week Oct
6	Survey of the silkworm disease and data collection for October crop	4 <sup>th</sup> week October	4 <sup>th</sup> week Nov.
7	Data compilation of Disease Survey Report from nested units	Dec	Jan
8	Survey of the silkworm disease and data collection for February crop and submit annual / final report	February	Mar

### 14.8.3. TIME SCHEDULE OF ACTIVITIES / MILESTONES FOR JHARKHAND

#	SCHEDULE OF ACTIVITIES	Starting	Ending
1	Data compilation of Disease Survey Report from nested units	Apr	June
2	Survey of the silkworm disease and data collection for August crop	July	Aug
3	Data compilation of Disease Survey Report from nested units	1 <sup>st</sup> week Sep	4 <sup>th</sup> week Sep
4	Survey of the silkworm disease and data collection for October crop	1 <sup>st</sup> week Oct	3 <sup>rd</sup> week Oct
5	Survey of the silkworm disease and data collection for October crop	4 <sup>th</sup> week Oct	4 <sup>th</sup> week Nov.
6	Data compilation of Disease Survey Report from nested units	Dec	Jan
7	Survey of the silkworm disease and data collection for February crop and submit annual / final report	Feb	Mar

### 14.8.4 TIME SCHEDULE OF ACTIVITIES / MILESTONES FOR KALIMPONG

#	SCHEDULE OF ACTIVITIES	Starting	Ending
1	Survey of the silkworm disease and data collection for Spring crop	Apr	May
2	Survey of the silkworm disease and data collection for Summer crop	June	July
3	Survey of the silkworm disease and data collection for Autumn crop	Aug	Sep
4	Data compilation of Disease Survey Report from nested units	Oct	Jan
5	Submit annual / final report	Feb	Mar

#### 14.8.5 TIME SCHEDULE OF ACTIVITIES / MILESTONES FOR JORHAT

#	SCHEDULE OF ACTIVITIES	Starting	Ending
1	Survey of the silkworm disease and data collection for Spring crop	1 <sup>st</sup> week April	4 <sup>th</sup> week April
2	Survey of the silkworm disease and data collection for May crop	May	June
3	Survey of the silkworm disease and data collection for Summer crop	1 <sup>st</sup> week July	4 <sup>th</sup> week July
4	Survey of the silkworm disease and data collection for August crop	Aug	Sep
5	Survey of the silkworm disease and data collection for October crop	Oct	Nov
6	Data compilation of Disease Survey Report from nested units	Dec	Jan
7	Survey of the silkworm disease and data collection for February crop and submit annual / final report	Feb	Mar

#### 14.9. Programme Implementing Agency/ Agencies:

Name of the Agency	Address of the Agency	Proposed Research Aspects	Proposed Amount (Rs in lakh)	Cost Sharing %
Central Silk Board	Central sericultural Research & Training Institute, Central Silk Board, Bangalore	Research project	51.50 lakh	100%
Total:			51.50 lakhs	100%



## PART-IV: BUDGET PARTICULARS

**15. BUDGET** (in Lakhs): [In case of multi-institutional projects, the budget details should be provided separately for each of the Institute]

**TOTAL: 51.50 Lakh (CSR&TI – 6.00 lakh & RSRs/REC – 45.50 lakh) [Rs 6.50 lakh for each Centre]**

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

#	Item	Year 1	Year 2	Year 3	Total (Rs in lakh)
1	Binocular phase contrast microscope 4 nos.for 8 RSRs	6.40	-	-	6.40
2.	Refrigerator double door 300 L 8 nos. [4 for 4 RSRs and one for CSR&TI, Berhampore.]	3.60	-	-	3.60
3.	One P.C. / Laptop for CSR&TI,Berhampore with TFT monitor	1.00			1.00
	<b>Sub total A</b>	<b>11.00</b>	-	-	<b>11.00</b>

### B) Recurring

B.1. Manpower: JRF – 01 (6.00 FOR CSR&TI)

#	Position No.	Consolidated Emolument	Year 1	Year 2	Year 3	Total (Rs in lakh)
1	JRF 1 No	12000+10% HRA (I & II year) 14000+10% HRA (III year)	1.80	1.80	2.40	6.00
<b>Total</b>						<b>6.00</b>

### B.2 Consumables

#	Item	Qty	Year 1	Year 2	Year 3	Total (Rs)
1.	Chemicals / Glassware (CSR&TI,Berhampore)		0.25	0.25	0.25	0.75
2.	Chemicals / Glass ware (4RSRs and 3RECs)		1.75	1.75	1.75	5.25
<b>Sub total</b>						<b>6.00</b>

<b>Other items</b>	<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>	<b>Total (Rs)</b>
B.3 Contingency : CSR&TI,Berhampore 4 RSRSs and 3RECs	0.25 1.75	0.25 1.75	0.25 1.75	0.75 5.25
<b>Sub total B.3</b>				<b>6.00</b>
<b>B.4 Travel :</b> CSR&TI,Berhampore 4 RSRSs and 3RECs	0.50 7.00	0.50 7.00	0.50 7.00	1.50 21.00
<b>Sub total B.4</b>				<b>22.50</b>
<b>Sub-total of B (B.1+B.2+B.3+B.4)</b>				<b>51.50</b>
<b>Grand total (A+B)</b>				<b>51.50</b>

**Total cost of the project Rs: 51.50 lakh**

#### **PART V: EXISTING FACILITIES**

Resources and additional information

1. Vehicle: Institute / RSRS vehicle to be provided for the purpose during the visit.
2. Laboratory: Available
3. Manpower / Labourers: Available for ongoing research programme at the main and RSRS/REC Institutes.
4. Other resources: Available Refrigerator will be utilized till purchase.

## PART VI: DECLARATION/CERTIFICATION

It is certified that

- a) the research work proposed in the scheme/project does not in any way duplicate the work already done or being carried out elsewhere on the subject.
- b) the same project proposal has not been submitted to any other agency 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 scheme/project will be made in the Institute/University/State budget in anticipation of the sanction of the scheme/project.
- e) if the project involves the utilisation of genetically engineered organisms, we agree to submit an application through our Institutional Biosafety Committee. We also declare that while conducting experiments, the Biosafety 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 concerned ethical Committees/Competent authorities and the same would be conveyed to the Department of Biotechnology before implementing the project.
- g) it is agreed 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 Annex-V.
- h) we agree to accept the terms and conditions as enclosed in Annexure-IV. The same is signed and enclosed.
- i) the institute/university agrees that the equipment, other basic facilities and such other administrative facilities as per terms and conditions of the grant will be extended to investigator(s) throughout the duration of the project.
- j) the Institute assumes to undertake the financial and other management responsibilities of the project.

Director  
Chief Executive Authority  
Date:

Scientist-D (Seri)  
CSR&TI, Berhampore  
Co-ordinator  
Date:

Joint Director, DOT (Seri),  
Govt. of West Bengal, Odisha, Jharkhand, Assam  
Co-ordinator  
Date:

Scientist-D  
NSSO,CSB,  
West Bengal, Odisha, Jharkhand, Assam  
Co-ordinator  
Date:

(Dr.S.Chakrabarty)  
Scientist-C  
Principal Investigator  
Date:

Co-Investigators / Team Leader  
Date: