

PART I : GENERAL INFORMATION

1	Name of the Institute / University / Organization submitting the Project Proposal	Central Sericultural Research and Training Institute, Berhampore, West Bengal, Pin - 742101
2	Status of the Institute (s)	-
3	Name (s) and designation (s) of the Executive Authority of the Institute / University forwarding the application	Dr. B.B.Bindroo Director
4	Project Title:	PPS-3504: Study of Root Rot Disease of Mulberry in the Gangetic Plains of West Bengal and Development of its Control Measures
5	Category of the Project	R& D
6	Specific Area	Mulberry disease management
7	Duration	3 Years (2013 – 2016)
8	Total cost:	Rs. 3.48 Lakh
9	Is the Project single Institutional or multi-institutional	Institutional
10	If the Project is multi – institutional please furnish the following :	--

11 (a) . Project Summary:

Mulberry (*Morus alba*, L.) belongs to family Moraceae is deciduous in nature and the sole food plant of silkworm (*Bombyx mori* L.). Being perennial in nature it is often affected by large number of diseases caused by bacteria, virus, fungus and nematode. Mulberry can be grown under various climatic conditions from temperate to tropical regions. Timely cultural operation like, pruning, application of FYM and chemical fertilizers, arrangement for field sanitation and timely application of pesticides/ fungicides not only increase productivity and quality of leaf but also increase cocoon yield. Moreover, selection of proper broad spectrum, cost effective and ecofriendly fungicides is the best option for sustainability of the industry. Root and shoot system of any plant inhabits two different environments, the soil and the sub aerial environment. Root infecting fungi are generally a natural ecological group of pathogens that are distinct air borne fungi causing disease in the shoot system. Root disease is very less related with meteorological parameters other than rainfall. The buffering effect of soil mass does not permit the wide fluctuation in temperature and atmospheric humidity. Root rot is also a major problem in mulberry plant cultivation. In India the damage caused by root rot disease of mulberry is more or less significant. Total loss of leaf yields due to rot disease is 14% as reported from South India (Anonymous

1992). In the present study severity of root rot disease will be collected from different locations of Murshidabad district, Malda and Birbhum in the form of disease incidence (%). In this connection root protection method for Gangetic plains of West Bengal will be developed and the technology will be popularized. In vitro control measure will be studied for screening of fungicide. Earlier In vitro study Fidanza et al (2009) reported the response of 26 fungicides related to fungal growth.

11 (b). Aim :

As the mulberry plants of the Gangetic plains of W.B. are mostly very old and bottom pruning system is the traditional practice , hence the root portion should be protected for sustainability of leaf yield.

PROFORMA – I

PART II : PARTICULARS OF INVESTIGATORS

- 12 Name **Dr. S. K. Dutta**
Date of birth : 20.04.1957
Sex Male
Indicate whether Principal Investigator / Co-investigator Principal Investigator
Designation & Department Scientist-C, Mulberry Pathology Section
Institute / University : Address Central Sericultural Research and Training Institute, Berhampore, West Bengal, Pin - 742101
- Name **Dr. S.P.Chakraborty**
Date of birth **04.05.1954**
Sex Male
Indicate whether Principal Investigator / Co-investigator Co Investigator
Designation & Department Scientist-C
Institute / University : Address Research Extension Centre, Nabagram, Murshidabad
- Name **Mr. A. K. Dutta**
Date of birth 27.11.1955
Sex Male
Indicate whether Principal Investigator / Co-investigator Co Investigator
Designation & Department Scientist-C
Institute / University : Address Research Extension Centre, Bagmara, Malda, W. B
- 13 No. of Projects being handled by each Investigator at present
- | | |
|----------------------|---|
| Dr. S. K. Datta | 1 |
| Dr. S. P.Chakraborty | 1 |
| Mr. A. K. Datta | 1 |

PART III : TECHNICAL DETAILS OF PROJECT

15. Introduction:

Incidence of disease and pests is one of the major problems in the Gangetic plains of West Bengal. In the plant system pathogenic root infecting fungi in fundamentally different from the air borne fungal pathogens (Garret 1977). Infection by air borne fungal pathogen of the shoot system are critically dependent upon the physical factors of the subareal environment, such as temperature, wind velocity, atmospheric turbulence, humidity and rainfall (Gregory 1961). Infection of the shoot system is affected by the meteorological parameters in mulberry plants (Padmanaban, 1965; Nagrajan and Singh, 1975; Saxena and Lal, 1984; Bhattacharya *et al.* 1982; Shanta, 1960; Magar and Kurundkar, 2005; Krishnaven *et al.*, 2008, Van Everdingen, 1926; Krause and Massie, 1975; Madden *et al.* 1978; Pitbalado, 1992, Huaccho (1999). Like other plants mulberry is infected by fungi, bacteria, virus, mycoplasma and nematode (Yokoyama, 1962; Rangaswami *et al.*, 1978; Sengupta *et al.*, 1990; Yashihiko, 1995). Loss of leaf yield due to leaf spot, powdery mildew and leaf rust diseases is 46.80%, 20.45% and 17.35 % respectively at maximum disease severity (Anonymous, 1996). Besides these, disease also reduces leaf quality leading to poor silkworm rearing and crop loss up to 54.56% and 55.59% at maximum severity of leaf spot and powdery mildew diseases (Qadri *et al.*, 1998; 1999). Crop loss due to disease and pests was recorded in FAO (1967). There are different root disease of mulberry as reported. Fusarium root rot occurs during rainy season in the tropical places of India. It mostly attacks the planted nursery cuttings and saplings. In Andhra Pradesh, Tamilnadu and Karnataka this is a serious problem. Related to root disease of mulberry Philip *et al.* (1995) reported that *Fusarium oxysporum* and *Fusarium solani* are root infecting fungi of mulberry, which can be controlled by the application of Carbendazim and Mancozeb.

15.1 Definition of Problem:

Farmers of West Bengal are marginal and having limited land holdings, but sericulture is one of the primary occupations for livelihood of agrarian population of the Gangetic plains of West Bengal. Farmers field of Murshidabad and Birbhum area are infected with rot diseases as per our preliminary observation. Some specimens of rot disease were sent to IARI, New Delhi for identification. Sustainability of leaf yield mostly depends on disease free plants and in turn it improves silk production and development of sericulture industry as a whole. As the plants of the mulberry field of the Gangetic plains of West Bengal are very old, so root portion should be protected for sustainability of leaf yield.

15.2 Origin of the Proposal / Rationale of the Study:

Bottom pruning of mulberry plants (*Morus alba L.*) is a traditional practice for sericulture in West Bengal, hence root of mulberry should be protected as a plant protection method for sustainability of leaf yield. Root rot is one of the major problems (related to root) of mulberry cultivation in the Gangetic plains of West Bengal. It is a very serious problem in Birbhum and Murshidabad district. Root rot is generally caused by fungi *Fusarium solani*

and *F. oxysporum* as reported, appears in all types of soil and climate through out the year in South India. As shoot feeding in silkworm rearing in West Bengal is in vogue, so ground level pruning is done in each rearing season and as such pathogen remains in the soil as to complete the life cycle. In such case root of the plant should be protected through plant protection method. Emphasis for root protection would be given through development of package, applicable to the mulberry fields of West Bengal. More over naked end of the pruned portion of plants should be protected. Preliminary observation at Bangalgram area of Malda district shows the rate of infection 20 – 29% and the pathogen as identified from IARI, New Delhi is *Lasiodyplodia theobromae* (Pat.) Griff. & Maubl. (= synonym *Botryodiplodia theobromae* Pat.)

15.3. Relevance to the Current Issues and Expected outcome:

Management of root diseases of mulberry of Gangetic plains of West Bengal is required as the plants are mostly old. More over bottom pruning system is the traditional practice. For successful management of root diseases, root portion and the cut end of the pruned region of the of the existing plants should be protected by application of fungicide. If root is protected sustainability of leaf yield can be assured.

15.4. Objectives:

- 1) Preparation of data base of the severity of root rot disease of mulberry of the Gangetic plains of West Bengal.
- 2) Development of package for plant root protection method.
- 3) Popularization of plant root protection method.

16.1. INTERNATIONAL STATUS

Root rot disease is a major problem in mulberry cultivation in China, Japan, and Thailand Akoi (1971). Sadlin (1992) reported that *Phoma* and *Botryodiplodia* causes root rot in different plants. Cotton root rot of mulberry was reported from USA. The fungus *Phymatotrichum* sp. is characterized by globose to elliptical conidia. *Armillaria* sp. is also reported from USA causing Mushroom root rot of mulberry. The disease appears as rotting of hard wood in root Rhizomorphs of the fungal pathogen generally occur on healthy root. Ito (1941) reported Violet root rot disease of mulberry in China, Japan and Korea. At initial stage of the disease development symptoms of the host plant do not appear but later the leaves become yellow and the plant growth is stunted. The symptoms are expressed in two ways when the plants are either die or remains in a stunted growth. Strands of mycelia of violet brown or dark violet colour develop on the surface of root. Sclerotia of violet red colour remains in the rotten root. Dead tree can easily be up rooted Sakurai (1952) reported White root rot in Japan., where this disease is very common and causes extensive damage to mulberry fields by killing the well established plants. The infection of the disease is confined to the root system. Growth of the plants are generally weaken and foliage turns into yellow in colour and falls prematurely. Superficial grayish white mycelial web is formed in the effected roots of mulberry and affects the root system.

1.2. NATIONAL STATUS

In South India root rot disease of mulberry causes 14% loss of leaf yield (Anonymous,1992) . This disease was reported from Kerala, Tamilnadu, Karnataka and Andhra Pradesh (Tomy Philip *et al* 1995). In root rot disease plants show withering of leaves resulting to mortality. Extensive root damage is the important underground symptoms of the disease. The above ground symptom shows withering of leaves followed by defoliation. Species of *Fusarium* , causing root rot was reported as different variety of plants (Bilgrami et el 1979, 1981)*Fusarium oxysporum* causes root rot disease in different plants as reported by Govindarajan,1992; Gupta et el, Haware and Joshi,1973. Most of the scientists had worked in the foliar diseases of mulberry . *Fusarium* root rot of mulberry was reported by different scientists from South India. From West Bengal it is not yet reported. In *Fusarium* rot plants above the ground level show sudden withering of leaves and defoliation occurs. Various types of root rot diseases differ in their symptoms. Root rot caused by *F.solani* and *F.oxysporum* is more prevalent in South India

On evaluation of various antagonistic microbes under in vitro and in vivo conditions, an isolate of *Trichoderma harzianum* isolated mulberry field has been found most potential against *Fusarium* root rot disease, but rot disease of the Gangetic plans of West Bengal has not yet been reported.

16.3 IMPORTANCE OF THE PROPOSED PROJECT IN THE CONTEXT OF CURRENT STATUS

- 1) In the context of current status, preliminary survey at Bangalgram of Malda shows 20 – 29% rot infection in S1635.
- 2) Kalyanpur area of Birbhum district is infected with rot diseases (10 – 15%) in S1635 as reported.
- 3) The technology developed from CSR&TI Mysore for root rot disease is application of Diathane M – 45 (@ 10 gms/plant) and after 15 days application of RAKSHA (*Trichoderma herzianum*). RAKSHA : FYM in the ratio 1:50 is to be applied in the soil @ 500 gms/plant when the pathogen is *Fusarium oxysporum* or *Fusarium solani*.
- 4) For nursery bed application of NURSERY GUARD (*Trichoderma pseudoconingii*) to be mixed with FYM in the ratio 1:60 and to be applied 50 gms/pit before nursery plantation. When pathogen is *Laciodiplodia theobromae*.
- 5) Rot fungus collected from Malda area was sent to IARI, New Delhi and reported as *Laciodiplodia theobromae* (= *Botryodiplodia theobromae*), but plantation is old. Hence in vitro control measure should be studied. Proper bio control measure should be studied.
- 6) Mode of infection of *L.theobromae* is through wound or through naked pruned region , hence naked portion of the pruned region should be protected by fungicide which is not yet been developed, moreover bottom pruning system is the traditional practice in Malda, Birbhum and Mushidabad of W.B.
- 7) Existing old plants should be protected in the Gangetic plains if W.B.
 - a) Application of fungicide in the soil.
 - b) Application of fungicide in the cut ends of the pruned plants

- 16.4. ANTICIPATED PRODUCT, PROCESS/TECHNOLOGY, PACKAGES, INFORMATION OR OTHER OUTCOME FROM THE PROJECT AND THEIR EXPECTED UTILITY**
- Development of mulberry plant root protection method.
- 16.5 EXPERTISE AVAILABLE WITH PROPOSED INVESTIGATION GROUP / INSTITUTION ON THE SUBJECT OF THE PROJECT**
- The investigating group has necessary expertise to implement the project.

LIST OF FIVE EXPERTS IN INDIA IN THE PROPOSED SUBJECT AREA:

Sl.no.	Name	Designation	Address
1			

17. WORK PLAN

17.1 Methodology

A. Location of the experiment:

Location	Farmers field under RECs Nabagram, Mothabari; DOT (Seri) farms, Govt. of West Bengal at Bhadrapur, Boswa, Kolitha; and farmers field of Murshidabad area.
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I- Disease assessment Study of disease severity (In Malda, Murshidabad and Birbhum districts):

- Each location will be surveyed and disease incidence data will be recorded.
- DOS farm/ farmers field will be observed.
- In each village data will be collected from three farmers' fields.
- Disease severity data will be collected in each quarter of the year.
- The incidence of root rot is determined on the basis on the number of plants infected in a population of plants of mulberry garden.
- Disease incidence will be recorded as related with the age of the plants.

Disease incidence is calculated using the following formula

1. Infection percentage or percent incidence (D. I.)

$$\text{Disease incidence (\% D.I.)} = \frac{\text{Number of plants infected}}{\text{Number of the plants observed}} \times 100$$

Age of the plants to be considered in three groups:

I = < 10 years old plantation

II = 10 – 20 Years old plantation

III = > 20 years old plantation

% of incidence related to the age of plant in different locality of Malda , Murshidabad and Birbhum will be recorded and compiled.

II. In vitro cultural of rot disease and study of control measure by application of fungicide.

In Vitro study of the fungus (One experiment) :

E01: In vitro selection of fungicide, which can control root rot disease.

Diseased host tissue from the rot portion of root is selected for isolation of pathogen. Small pieces are cut in to small bits of 2/5 mm. and surface is sterilized with 0.1% mercuric chloride. Pieces are then washed with sterile distilled water and dried. Later transferred to petriplates with PDA (peeled potato 200 g, dextrose 20 g, agar 15 g and distilled water 1L) media through sterilized inoculation needle in laminar flow chamber . Plates are then incubated at 25 – 28 °C

The fungus is allowed to grow and to be sub cultured. Mother culture is to be preserved in the refrigerator as stock.

Fungicide concentrations

Slno.	Fungicide	Trade name	Required concentration
1	Carbendazim	BAVISTIN	0.1% / 0.15% / 0.2%
2	Mancozeb	INDOFIL – M-45	0.2% / 0.15% / 0.1 %
3	Trichoderma viridi (Bio fungicide)	TRICHOSTAR	10% / 20% / 30 %

Decoction of 200 gms of peeled potato(extracted from 1lt distilled water) to be mixed with 20 gms dextrose sugar, 15 gms agar (SRL) and 1 litre distilled water and then boiled in 2lt conical flask, then to be autoclaved at 15 PSI (Pound per square inch) for 20 minutes (121.6°C).Fungicide of required concentration is to be added in agar in 1:15 ratio before solidification. No fungicide is to be added in control plates.

The experiment to be conducted in randomized block design (RBD) and to be conducted during July 2013.

In the experiment (Ist Phase , during July,13)

3 fungicides viz. Carbendazim, Mancozeb, and bio fungicide *Trichoderma viridi* is considered in 3 concentrations + 3 control plates.

Total n = 30 plates (3 x 3 x 3+ 3 = 30)

Treatments will be identical in the second II nd phase of Experiment during October,2013.

Percent inhibition to be calculated as Fidanza(2009)

$$\text{Percent inhibition} = 1 - \frac{\text{Mean fungal colony diameter of treated media}}{\text{Mean fungal colony diameter of control media}} \times 100$$

Fungicide with maximum prohibition of fungal growth will be screened and to be applied in the soil (mixing with soil) and the recommended concentration to be mixed with ordinary talc for application in the cut end of the pruned region.

Recommended package will be popularized.

17.2 ORGANISATION OF WORK ELEMENTS

SL. NO.	NAME	DESIG-NATION	TIME TO BE SPENT	WORK TO BE DONE
1	Dr. S. K. Dutta Principal Investigator	Scientist-C	50%	<ul style="list-style-type: none"> • Co-ordination and implementation of the project. • Survey collection and identification of rot disease specimens • Compilation of disease incidence report. • In Vitro study of rot disease specimens
4	Dr. S.P.Chakraborty Co Investigator	Scientist-C	10%	<ul style="list-style-type: none"> • Execution and implementation of the project in Birbhum district.
5	Mr. A. K. Dutta Co Investigator	Scientist-C	10%	<ul style="list-style-type: none"> • Execution and implementation of the project in Malda district.

17.3 PROPRIETARY / PATENTED ITEMS, IF ANY, EXPECTED TO BE USED FOR THIS PROJECT : NIL

17.4 SUGGESTED PLAN OF ACTION FOR UTILIZATION OF THE EXPECTED OUTCOME FROM THE PROJECT : Management of Root Rot of mulberry of the Gangetic plains of West Bengal.

17.5. TIME SCHEDULE OF ACTIVITIES GIVING MILESTONES

Sl. No.	Milestone / Activity	Expected Date of		Expected Outcome / visible/ measurable indicator
		Starting	Completion	
1	Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts.	Apr,2014	Dec,2016	To identify the fungus causing rot disease in the mulberry fields of Gangetic plains of West Bengal.
2	Recording and data compilation.	Apr,2014	Dec,2016	To generate disease (rot) data base of Gangetic plains of West Bengal
4	In vitro culture of rot disease specimens and study of control measure. Isolation of fungicide and application in the field.	July,2014	June,2016	Isolation of the fungicide , which can control rot disease of mulberry.
5	Data analysis Development of Plant root protection method.	Jan.,2017	March,2017	Development of plant root protection method.
6	One set of sub culture (of rot specimens) to be sent to Indian Type Culture Collection, IARI, New Delhi.	Jan.,2017	Jan.,2017	For future preservation / further study of the disease and to confirm the identity of the culture.
7	Preparation of final report	March,2017	March,2017	Prepare final report of the project.

17.6. Month wise Work Calendar

17.7. Work Calendar (2013-14)

Sl. No.	Month	Work
1	Apr.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation.
2	May	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation.
3	June	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts.

		2) Recording and data compilation.
4	Jul	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
5	Aug.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
6	Sept.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
7	Oct.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
8	Nov.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
9	Dec.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
10	Jan.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
11	Feb.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
12	Mar.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study

17.8. Work Calendar (2014 - 15)

Sl. No.	Month	Work
1	Apr.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
2	May	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts.

		2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
3	June	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
4	Jul	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
5	Aug.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
6	Sept.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
7	Oct.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
8	Nov.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. In vitro culture of rot disease specimens and study
9	Dec.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
10	Jan.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. In vitro culture of rot disease specimens and study
11	Feb.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
12	Mar.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study

17.9. Work Calendar (2015 - 16)

Sl. No.	Month	Work
1	Apr.	1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study

2	May	<ol style="list-style-type: none"> 1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
3	June	<ol style="list-style-type: none"> 1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation. 3) In vitro culture of rot disease specimens and study
4	Jul	<ol style="list-style-type: none"> 1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation.
5	Aug.	<ol style="list-style-type: none"> 1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation.
6	Sept.	<ol style="list-style-type: none"> 1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation.
7	Oct.	<ol style="list-style-type: none"> 1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation.
8	Nov.	<ol style="list-style-type: none"> 1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation.
9	Dec.	<ol style="list-style-type: none"> 1) Survey, collection and identification of rot disease specimens from Malda, Murshidabad and Birbhum districts. 2) Recording and data compilation.
10	Jan.	<ol style="list-style-type: none"> 1) One set of sub culture (of rot specimens) to be sent to Indian Type Culture Collection, IARI, New Delhi. 2) Data analysis. 3) Development of plant root protection method.
11	Feb.	<ol style="list-style-type: none"> 1) Data analysis. 2) Development of plant root protection method.
12	Mar.	<ol style="list-style-type: none"> 1) Data analysis. 2) Development of plant root protection method. 3) Submission of Final Report – Part - 10

17.10. Project Implementing Agency/ Agencies

Name of the Agency	Address of the Agency	Proposed Research Aspects	Proposed Amount	Cost Sharing (%)
Central Silk Board	BTM Layout, Madivala, Bangalore - 560 068	Study of Root Rot Disease of Mulberry in the Gangetic Plains of West Bengal and Development of its Control Measures	Rs 3.48 Lakh	
Total :			Rs 3.48 Lakh	

PART IV: BUDGET PARTICULARS

18. **BUDGET (In rupees):** [In case of multi-institutional project, the budget details should be provided separately for each of the institute]

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

Sl. No	Item	2 nd Year	3 rd Year	4 th Year	Total
1	Camera (To be fitted with Microscope)	25,000	--	--	25,000
5	Laptop 1	30,000	--	--	30,000
	Sub total A:	55,000	--	--	55,000

B. Recurring:

B2. Consumables:

Sl. No.	Item	2 nd Year	3 rd Year	4 th Year	Total
1	Stationeries	15000	15000	5,000	38,000
2	Chemicals & Fertilizer	20,000	20,000	5,000	45,000
3	Glassware	20,000	5,000	0	25,000
	Sub total B2	55,000	40,000	10,000	1,08,000

Other Items:

S. No.	Item	2 nd Year	3 rd Year	4 th Year	Total
B3	Travel	50,000	50,000	20,000	1,25,000
B4	Contingency	15000	15000	15000	60,000
B5	Overhead charges/ Publicity	0	0	0	0
	Sub total ;B1+B2+B3+B4+B5	1,20,000	1,05,000	45,000	2,93,000
	Grand Total	1,75,000	1,05,000	45,000	3,48,000

Total budget	Rs 3,48,000
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PART V: EXISTING FACILITIES:

19. AVAILABLE EQUIPMENT AND ACCESSORIES TO BE UTILIZED FOR THE PROJECT:

Sl No.	Name of the Equipments/ Accessory	Make	Model	Funding Agency	Year of Procurement
1	Stevenson screen			CSB	2005
2	Anemometer			CSB	2006
3	Sunshine recorder			CSB	-
4	Raingauge (Self recording and Manual)			CSB	2007
5	Open Pan Evaporometer			CSB	2005
6	Soil Thermometer			CSB	2010
7	Dry bulb thermometer			CSB	2010
8	Wet Bulb Thermometer			CSB	2010
9	Max. Thermometer			CSB	2010
10	Min. Thermometer			CSB	2010
11	AWS (Automatic Weather Station) For Kalimpong and Koraput			CSB	2011
11	AWS (Automatic Weather Station) (Supplied by India Meteorological Department, Pune) for Main Institute.			Free of cost	2011

PART VI : REFERENCES

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**PART VII : BIODATA OF PROJECT COORDINATOR / PRINCIPAL INVESTIGATOR / CO-
INVESTIGATOR (S)**

1. Full Name (In Block letters) : **Dr. S.K.DUTTA**
2. Designation : Scientist- C
3. Department / Institute / University : Central Sericultural Research and Training
Institute, Berhampore-742101, WB.
4. Date of birth : 20.04.1957
5. Sex : Male
6. Education (Post Graduation onwards & Professional Career)

Name of the University	Degree Passed	Year of Passing	Subjects taken with Specialization	Class / Division
University of North Bengal	M. Sc	1981	Botany (Spl. Pteridology)	1 st .
Visva Bharati University	Ph. D	1985	Mycology and Plant Pathology	--

7. Awards:
[Not required for in-house personnel]

Year	Award	Agency	Purpose	Nature

8. Positions Held / Research Experience in various institutions:
[Not required for in-house personnel]
9. Memberships/ Fellowships : [Not required for in-house personnel]
10. Patents : [Not required for in-house personnel]

11. Publications (Numbers only) :
Books : 1
Research Papers, Reports : 23 + 3
General articles
:

List of important publications whose contents can be used in the proposed area of work :

- (1) S.Dutta and Anjali Roy,(1983) Sexuality of *Polyporus bicolor*,Jungh; Curr.Sci, 20:52:989-990.
- (2) Anjali Roy and S.Dutta ,(1983) Taxonomy of *Polyporus bicolor*, Jungh; Biol.Bull of Ind.,5(2): 115-120.
- (3) S.Dutta and Anjali Roy, (1985) Notes on *Microporus xanthopus*, Fr.Kunt; Nova Hedwigia,42:1-7.
- (4) A.Mitra,S.Dutta and Anjali Roy,(1985): New records of two wood rotting fungi from India; Indian Forester,Vol:III,2:78-81.
- (5) Anjali Roy and S.Dutta (1985) Xanthochroic reaction of some Hymenochetaceae and Polyporaceae; (National Symposium in Photochemistry in relation to Botanical classification) Synp Vol. Bhagalpur University 17th 19th Feb,85

- (6) S.Dutta and Anjali Roy (1985) Sexuality and monokaryotic fruiting of *Trametes rigida*, Berk; Curr.Sci,50:2.
- (7) S.Dutta and Anjali Roy(1986) Taxonomy of *Irpex vellerius*, Berk and Br. Symposium Vol. National seminar in Recent Trends in Plant Science Research Visva Bharati Univ. 18-19th Feb.
- (8) S.Jana, S.Dutta,A.Mitra,and Anjali Roy (1987) Effect of plant growth regulators in some wood rotting polypores:Folia Microbiologica:32:481-484.
- (9) S.Dutta and Anjali Roy (1988) Taxonomy of *Coriolopsis proteus*,Comb.nov:Int.J.Myc.Lich:3(2/3):235-246.
- (10) M.Sahu, A.K.Sahu, S.K.Dutta and B.B.Bindroo (2006)Disease and pest management of mugasilkworm Host plants:Workshop [,Prospects of Muga Sericulture in Coochbehar,WB.) Organized by CMER&TI,Lahdoigarh,20-21st Jan,2006.
- (11) B.B.Bindroo and S.K.Dutta (2006) Package of practices for nursery raising , plantation, maintenance , pest and disease management of muga host plants: Resource development programme under CDP for Seri development in Assam, WB,and Sikkim (Organized by CSB) at Hotel Ambarish , GHY,30thOct-11th Nov,06
- (12) N.S.K Harsh, ,K.Uniyal and S.K.Dutta (2006) A new Canker disease in *Machilus bombycina* ; Ind.J.For,Vol-132,No-12,1692-1694.
- (13)B.B.Bindroo, A.K.Sahu, S.K.Dutta and R.Chakraborty, (2008)Large Scale production of Som planting material.. Indian Silk ,Vol. 47;No-8,20-21.
- (14) S.RoyChoudhury, N.Chakraborty, C.Maji, D.Pandit, S.K.Dutta,and A.K.Bajpai (2008) Technology intervention on mulberry sericulture for Eastern and North Eastern India. Abstract, National Conference on Vanya Silk, NASSI at CMER&TI,Lahdoigarh on 29th – 30th December,08 Pg.261
- (15) S.K.Dutta,S.Roy Choudhury,D.Pandit,P.C.Bose, and A.K.Bajpai (2009) Studies on rooting response and survival of different morphotypes of som plant (*Persea bombycina*, King ex Hook.F.,Kost.) Journal of Crop and Weed ,5(1):296 – 298.
- (16) S.K.Dutta, S.Roy Choudhury, D.Pandit and A.K.Bajpai (2010) Rot disease of muga host plant , Som (*Persea bombycina*, King ex Hook.F.Kost) and its management. Journal of Plant Protection Sciences 2; (2), 73 - 76.
- (17) S.K.Dutta,M.D.Maji,S.K.Mukherjee and A.K.Bajpai (2010) Major mulberry pests and diseases of West Bengal and their control measure. Proceedings on State Level Work shop on” Dissemination of Setriculture know how from Lab to Land”on 27th – 28th January,2010.at Kaliachwak ,Malda.pp. 10 – 13.
- (18) M.D.Maji,S.K.Dutta and C.Maji (2010) Epidemiology and prediction of brown leaf rust of mulberry caused by *Peridiopsis mori*. Abstract. National Symposium on Perspective in plant health

management, held on 14th – 16th December,2010 at Anand Agricultural University, Anand , Gujrat pp.61.

(19)S.K.Dutta, M.D.Maji,A.Ghosh,S.Roy Choudhury,B.Choudhuri,and M.K.Majumdar (2011) Study on different disease severity of mulberry (*Morus alba*L.) in different seasons of Aizawl district (Mizoram) Abstract. International Symposium on “ System intensification towards food and environmental security”at BCKV, Mohanpur on 24th -27th February,2011 pg. 301.

(20) M.D.Maji, S.K.Dutta, N.K.Das and C.Maji (2011) Epidemiology on prediction of Powdery mildew of mulberry caused by *Phyllactinia corylea*. Abstract. International Symposium on “ System intensification towards food and environmental security”at BCKV, Mohanpur on 24th -27th February,2011 pg. 209.

(21) S.K.Dutta, M.D.Maji,A.Ghosh,S.Roy Choudhury,B.Choudhuri,and M.K.Majumdar and B.B.Bindroo (2011) Survey on disease severity of mulberry (*Morus alba*L.) in different seasons of Aizawl district (Mizoram) Journal of Crop and Weed 7(2); pg.253.

(22) S.K.Dutta, M.D.Maji,M.K.Ghosh,A.Borah and B.B.Bindroo(2012) Study on correlation between meteorological variables and severity of Leaf rust of mulberry in Dimapur(Nagaland)- National Symposium on approaches to maximizing crop productivity at Institute of Agricultural science, University of Calcutta on 12 – 14 th January,2012- Book of Abstracts pg. 97.

(23) S. K, Dutta, M K. Ghosh, and B.B.Bindroo (2012) Study on severity of Powdery Mildew disease of mulberry in Eastern And North Eastern India; National Conference on “Recent Trends in Plant Sciences” organized by Tuljaram Chaturchand College, Baramati (Maharashtra), scheduled to be held during 3-5 February, 2012.Abstract of proceedings Pg.87.

(24) S. K.Dutta, M.D.Maji,, M.K.Ghosh and B.B.Bindroo (2012) Scenario of mulberry (*Morus alba L.*) diseases in Murshidabad district and its prophylactic measure State Level Seminar on “Advancement of Biological Science towards sustainable development”held at Berhampore Girls’ College, Berhampore,W.B. from 29th to 30th March, 2012; OP – 16.

12. Project (s) submitted / being pursued / carried out by Investigator :

Sl. No.	Title of the project	Funding agency	Duration From To	No. of Scientists / Associates working under the project	Total approved cost of the project
1	PIG-5829 Genome analysis of muga silkworm host plants (Som and Soalu) DNA profiling of certain elite genotypes using molecular markers and development of mapping populations. (Collaborative with SBRL, Kodathi) as CI	CSB	2004 to 2007	4 Scientists	Budget allotted at CMER&TI, Lahdoigarh.
2	Under CSS- 2107 (Central Sector Scheme) Development of forecasting and forewarning system of mulberry	CSB	2009 to 2012 (March)(During XI Plan period)	15 Scientists and 2 JRFs	18.06 Lakh

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

(1) (a) Worked as PI of the project CSS-2107 (Central Sector Scheme)

(*Development of forecasting and forewarning system of mulberry diseases.*) monitored and coordinated works of different locations of Eastern and North Eastern India along with 14 CIs and 2 JRFs.

(b) 2) Development of data base of different diseases (mulberry) of Eastern and Northeastern India is under progress (soft copy).

3) Compilation of disease data and calculated of correlation coefficient (r) of disease and meteorological data of Eastern and north Eastern India to establish disease weather correlation.

www.csrtiber.res.in- Disease forecasting forewarning.

4) Developed of disease forecasting model different diseases of different locations, where severity is >ETL in Eastern and North Eastern India.

5) Study of morphology and Culture (In PDA media) of disease specimens and study of disease severity was done.

A new endophytic fungus (*Acremonium roseogriseum*) is very common in the mulberry leaves of Aizawl district. In PDA media it shows;

Fungal colony attained 3 cm. in diameter in 20 days at 24+_ 1°C on PDA media. slender, phalades mostly single (Cylindrical inshape) , erect, arising from apical hyphae The growth rate of *Acremonium* in culture media is rapid. Mat is ash coloured membranous slightly powdery advance zone is wooly floccose.

Acremonium is one of the causative agents of eumycotic white grain mycetoma. Rare cases of onychomycosis, keratitis, endophthalmitis, endocarditis, meningitis, peritonitis, and osteomyelitis due to *Acremonium* have also been reported. *Acremonium* species are cosmopolitan in nature, and are also encountered as contaminants. hence preparation of culture requires cautious evaluation.

6) Attended National/International seminar / Symposium.

Workshop / Seminar attended/ paper presented

Name of Work shop	Place	Organized by	Year	Paper presented by
All India Symposium on “ <i>Phytochemistry in relation to Botanical classification</i> ”	Bhagalpur University Bhagalpur	UGC & Bhagalpur University	1985	A.Roy
National Seminar in “ <i>Recent trends in plant science researches</i> ”	Visva Bharati University Santiniketan	VBU & DST	1986	S.K.Dutta
Workshop on strategies for non mulberry germplasm maintenance	CMER&TI Lahdoigarh	CMER&TI Lahdoigarh	2005	No Attended only
Resource development programme under CDP	Hotel Ambarish	CSB Bangalore	2006	S.K.Dutta

<i>“Maintenance and management of muga host plant”</i>	Guwahati			
Workshop on prospect of muga sericulture in Coochbehar, WB <i>“ Disease and pest management of muga silkworm and host plant”</i>	Coochbehar	CMER&TI Lahdoigarh	2006	M.Sahu
National Symposium on Climate change , <i>Plant Protection & Food security interface,</i>	BCKV Mohanpur	BCKV Mohanpur	2009	S.K.Dutta
State Level Work shop on <i>“Dissemination of Sericulture know how from Lab to Land”</i>	Kalia chwak College Malda	UGC & CSR&TI BHB	2010	S.K.Dutta
National Symposium on <i>“Perspective in plant health management”</i>	Anand Agricultural University, Anand , Gujrat	Anand Agricultural University	2010	M.D.Maji
International Symposium on <i>“ System intensification towards food and environmental security”</i>	BCKV Mohanpur	BCKV Mohanpur	2011	M.D.Maji
International Symposium on <i>“ System intensification towards food and environmental security”</i>	BCKV Mohanpur	BCKV Mohanpur	2011	S.K.Dutta

- (1) At P2 BSF, Dhubulia – Maintenance of mulberry plants (S1) and cultural operation as per crop schedule of West Bengal was done. Rearing of P2 dfls as per requirement of P1 seed cocoon and production of P1 dfls to supply diseases free seeds to the selected seed rearers.
- (2) At RMRS, Boko (Assam) Maintenance of GPB of muga food plant (*Persea bombycina*) was done in eight morphotypes of som plants (from S1 to S8) were maintained in the GPB plot. (Plot no7 of RMRS, Boko) Maintenance of Kesseru plants (*Hetetropanax fragrans*) at the nursery bed of RMRS, Boko was done. Survey identification and control of muga food plant diseases was done. A new report was made in the canker rot disease of som plant. A mass multiplication technique of vegetative propagation of som plant was developed to fulfill annual action plan of RMRS Boko. (Expansion of area under high yielding morphotype of som plant).
- (3) At CSR&TI Berhampore working as sectional In charge of Mulberry pathology section.

PART VII : BIODATA OF PROJECT COORDINATOR / PRINCIPAL INVESTIGATOR / CO-INVESTIGATOR (S)

1. Full Name (In Block letters) : **MR. A. K. DUTTA**
2. Designation : Scientist-C
3. Department / Institute / University : Research Extension Centre, Mothabari, Malda, West Bengal
4. Date of birth : 27.11.1955
5. Sex : Male
6. Education (Post Graduation onwards & Professional Career)

Name of the University	Degree Passed	Year of Passing	Subjects taken with Specialization	Class / Division
Klayani University	M. Sc	1978	Taxonomy in Angiosperm	II nd

7. Awards: NIL
[Not required for in-house personnel]

Year	Award	Agency	Purpose	Nature

8. Positions Held / Research Experience in various institutions: NIL
[Not required for in-house personnel]

9. Memberships/ Fellowships : [Not required for in-house personnel]: NIL

10. Patents : [Not required for in-house personnel] NIL

11. Publications (Numbers only) :
 - Books :
 - Research Papers, Reports : 07
 - General articles : NIL

List of important publications whose contents can be used in the proposed area of work :

12. Project (s) submitted / being pursued / carried out by Investigator :

Sl. No.	Title of the project	Funding agency	Duration From To	No. of Scientists / Associates working under the project	Total approved cost of the project
1	PRP-3352: Development of weather based forewarning system of mulberry diseases	Central Silk Board	2005-2010	10	39.474

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

Project	Outcome	Utilisation
Updation of improved package of practices for newly authorized mulberry varieties under irrigated condition.	Application VC (20 mt/ha/yr +AZB 20 kg/ha/yr) + AMF 75 20 kg/ha/yr, once in four year + N168 :P38 :K84 along with PGR performed significantly higher leaf yield in S1635	Exploitation is under progress
Studies on weed management in mulberry under irrigated condition.	Vigna sinensis was found to be promising towards weed control in existing mulberry garden without affecting leaf yield and quality and reduce expenditure towards cost of digging and weeding activity.	----
All India Co-ordinated experiment in mulberry (Phase-II)	MV8 and MV4 was superior than other tested varieties.	Exploitation required
Recommended BV and MV silkworm breeds in West Bengal	MC4 X BC4 and MC1 X MC4 performed better than the traditional multivoltine breed in the commercial seasons.	-
Assessment of phosphorus and requirement of mulberry (Morus alba) on Mitcherich Bray Concept	A ready reconer for phosphatic and potassic fertilizers have been worked out.	Exploitation is under progress
Technology assessment and refinement to IVLP under progress	Under progress	-

**PART VII : BIODATA OF PROJECT COORDINATOR / PRINCIPAL INVESTIGATOR / CO-
INVESTIGATOR (S)**

1. NAME : **Dr. S.P.CHAKRABORTI**
 2. EMPLOYEE NO. : **000361**
 3. OFFICIAL DESIGNATION : **Scientist - C**
 4. PROJECT DESIGNATION : **Co-Investigator**
 5. EXPERTISE AREA : **Mulberry Breeding & Tissue Culture,**
 6. INSTITUTE NAME : **CSR & TI, Berhampore**
 7. INSTITUTE ADDRESS : **CSR & TI, Berhampore, Murshidabad.**
 8. TELEPHONE : **(O) - 03482 -251046 (R) – 251865**
 9. TELEX : **-**
 10. FAX : **03482 – 251046**
 11. BIRTH YEAR : **04.05.1954**
 12. SEX : **Male**
 13. EDUCATIONAL :

HIGHEST DEGREE (DEGREE ONWARDS)	YEAR	UNIVERSITY	COUNTRY	SUBJECT
B.Sc (Hons.)	1973	Calcutta	India	Botany (Hons.)
M.Sc (Botany)	1976	Calcutta	India	Cytogenetics & Plant Breeding
Ph.D	1981	Calcutta	India	Plant Tissue Culture & Cytogenetics

14. TRAINING UNDERGONE :

COURSE NAME/ SUBJECT	ADDRESS OF INSTITUTE	DURATIO N	PERIOD		SPONSO-RING AGENCY	REMARKS
			FRO M	TO		
1.Mulberry Breeding	Zhejiang Agri. Univ., Hangzhou, P.R.China	4 months	Mar., 1994	July, 1994	CSB	-
2.Mulberry Breeding and Cultivation	CSR&TI, Mysore	12 days	Nov., 1996	Dec., 1996	CSB	-

COURSE NAME/ SUBJECT	ADDRESS OF INSTITUTE	DURATIO N	PERIOD		SPONSO-RING AGENCY	REMARKS
			FRO M	TO		

12. Project (s) submitted / being pursued / carried out by Investigator : As PI-3 as CI-2

Sl. No.	Title of the project	Funding agency	Duration From To	No. of Scientists / Associates working under the project	Total approved cost of the project
	PRP-3352: Development of weather based forewarning system of mulberry diseases	Central Silk Board	2005-2010	10	39.474
	CSS-2107 Development of weather based forewarning system of mulberry diseases	Central Silk Board	2009-2012	14	18.36

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

(1) (a) Worked as CI of the project CSS-2107 (Central Sector Scheme)

(*Development of forecasting and forewarning system of mulberry diseases.*) monitored and Birbhum district.

2) Development of data base of different diseases (mulberry) of Eastern and Northeastern India is under progress (soft copy).

3) Compilation of disease data and meteorological data and sending to CSR&TI,Berhampore.

PART VIII : 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 scheme.
- e. If the project involves the utilization of genetically engineered organism, it is agreed 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 that any patent(s) or industrial proprietary right(s) on the Invention(s) arising out of the project, shall be taken in the name of Central Silk Board and the Central Silk Board shall have the sole option(s) for including the name(s) of the others in such patent(s) industrial proprietary right(s).
- 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 through out the duration of the project.
- j. The institute assumes to undertake the financial and other management responsibilities of the project.

1. Signature of Project co-coordinator
[Applicable for inter-institutional projects only]

2. Signature of Executive Authority of Institute with Seal

Date :

Date :

3. Signature of Principal Investigator

Date :

4. Signature of Co-Investigator:

Date :

Handwritten signatures and names of project coordinators, executive authority, principal investigator, and co-investigators. The signatures are in blue ink on a white background. The names and titles are written in blue ink below the signatures. The names include: Alok Kumar Dutta, Ranuna Das, Dr. P.P. Chakrabarti, Dr. H.D. Maji, N.K. Das, Dr. S. Singh, and Dr. D. Parashar. There is also a signature of Dr. K.B. Chakrabarti and a signature of Dr. S. Singh. The number 61 is written in the bottom right corner of the signature area.