

वार्षिक अनुसंधान एवं प्रशासनिक प्रतिवेदन

Annual Research & Administrative Report

2012-13



केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान

Central Sericultural Research & Training Institute

केंद्रीय रेशम बोर्ड, वस्त्र मंत्रालय, भारत सरकार

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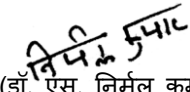
रेशम कृषि, पूर्वी एवं उत्तर-पूर्वी भारत में इस क्षेत्र की स्थलाकृति तथा कृषि जलवायु विभिन्नताओं के कारण अनन्य है। केन्द्रीय रेशम उत्पादन अनुसंधान व प्रशिक्षण संस्थान, बहरमपुर, पश्चिम बंगाल-रेशम कृषि अनुसंधान के क्षेत्र में एक प्रमुख संस्थान है जो सन् 1943 से ही पूर्वी एवं उत्तर पूर्वी क्षेत्र के विभिन्न भागों में स्थित अपने 4 क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्रों, 12 अनुसंधान विस्तार केन्द्रों एवं 2 उप-अनुसंधान विस्तार केन्द्रों के विस्तार जालतंत्र के माध्यम से रेशम कृषि के विकास हेतु अनुसंधान, विकास, विस्तार, मानव संसाधन विकास (एच. आर. डी.) जैसी सेवा सहयोग शहतूती रेशम कृषकों/स्टेकहोल्डरों को प्रदान करते आ रहा है।

मुझे, संस्थान के अनुसंधानात्मक व विकासात्मक उपलब्धियों को वार्षिक अनुसंधान व प्रशासनिक रिपोर्ट, 2012-13 के रूप में प्रकाशित करते हुए अपार हर्ष का बोध हो रहा है। साथ ही, यह भी रिकार्ड प्रस्तुत करते हुए बेहद प्रसन्नता हो रही है कि संस्थान को अपनी गुणवत्ता व उत्कृष्ट कार्य प्रबंधन के लिए दिनांक 17 जनवरी, 2013 को आई एस ओ 9001:2008 मानक की मान्यता से गौरवान्वित होने का श्रेय प्राप्त हुआ है। संस्थान तथा इसके अधीनस्थ इकाईयों में 19 परियोजनाएं, 30 कार्यक्रमों और 2 पॉयलट अध्ययन परिणाम फ्रेमवर्क दस्तावेज (आर एफ डी) के अधिदेशाधीन क्रियान्वित किए गए जिसमें से 1 परियोजना, 14 कार्यक्रमों और 2 पॉयलट अध्ययन संपन्न हो चुका है तथा व्यावसायिकों व स्टेकहोल्डरों में क्षमता निर्माण के माध्यम से उन्नत शहतूत प्रजातियों, रेशमकीट प्रजननों/संकरों के विकास, उनके प्रबंधन व विस्तार प्रबंधन में महत्व पूर्ण उपलब्धियां दर्ज की गई। साथ ही, संस्थान के जैव-प्रौद्योगिकी अनुसंधान को राष्ट्रीय ख्याति प्राप्त अन्य संस्थानों के साथ सहबद्ध किया गया है।

सुविज्ञ अध्यक्ष तथा अनुसंधान समन्वय समिति (आरसीसी), अनुसंधान सलाहकार समिति (आरएसी), क्षेत्रीय अनुसंधान सलाहकार समिति (आरआरएसी) सदस्यों द्वारा क्षेत्र में अनुसंधानात्मक व विकासात्मक लक्ष्यों की प्राप्ति हेतु वैज्ञानिकों को दिए गए बहुमूल्य मार्गदर्शन के प्रति अपना आभार व्यक्त करता हूं। विभिन्न राज्यों के वस्त्र निदेशालय (रेशम) रेशम निदेशालयों के अमूल्य सहयोग तथा समर्थन के लिए भी धन्यवाद ज्ञापित करता हूं।

श्रीमती इशिता राय, भा प्र से, सदस्य सचिव, केन्द्रीय रेशम बोर्ड द्वारा इस क्षेत्र में रेशम कृषि उद्योग के विकास हेतु आवश्यकता आधारित, स्टेकहोल्डर-मित्र तथा सहज अंगीकार्य प्रौद्योगिकियों को विकसित करने हेतु प्रदत्त निरंतर सहयोग एवं उत्साह वर्धन के लिए निष्ठापूर्वक अपनी कृतज्ञता एवं आभार प्रकट करता हूं।

मैं, अंततः संस्थान और संबद्ध केन्द्रों के वैज्ञानिकों, तकनीकी तथा प्रशासनिक पदधारियों को आर एफ डी के तहत निर्धारित लक्ष्यों पर सराहनीय उपलब्धियों तथा रेशम कृषि उद्योग के हित के लिए उनके अमूल्य योगदान देने हेतु उन्हें हार्दिक बधाई देता हूं।


(डॉ. एस. निर्मल कुमार)
निदेशक



FOREWORD



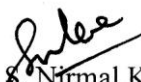
Sericulture in the Eastern & North-Eastern India is unique due to the topography and agro-climatic variations in this region. For sericulture development, since 1943, the Central Sericultural Research & Training Institute, Berhampore, West Bengal - the premier Sericulture Institute is rendering Research, Development, Extension, Human Resource Development (HRD) and Service supports to the mulberry sericulture farmers/ Stakeholders through its extension networking of 4 Regional Sericultural Research Stations, 12 RECs and 2 Sub-RECs located at different parts in the Eastern & North-Eastern region.

I am pleased to bring out the R&D interventions of the Institute in the form Annual Research & Administrative Report: 2012-13 and also happy to place on record that the Institute has been recognized as **ISO 9001:2008** standards on 17th January, 2013 for its quality out put management. With the mandated Results Framework Documents (RFD), 19 projects, 30 programmes and 2 pilot studies were pursued at the Institute and its nested units, of which, 1 project, 14 programmes and 2 pilot studies were concluded and made significant achievements in development of improved mulberry varieties, silkworm breeds / hybrids, their managements and extension management through capacity building in professionals and stakeholders. In addition, the Institute has tied up its biotechnological research with other Institute of national repute.

Sincerely acknowledged the valuable guidance rendered by the learned Chairperson and members of the Research Coordination Committee (RCC), Research Advisory Committee (RAC) and Regional Research Advisory Committee (RRAC) to the scientists for achieving the R&D aimed in the region. The invaluable cooperation and supports provided by the DoT (Seri)/ DoS of different states are also acknowledged earnestly.

Express sincere gratitude and thanks to Smt. Ishita Roy, IAS, Member Secretary, Central Silk Board for extending constant support and encouragement for developing need-based, stakeholders-friendly and easy-adoptive technologies for the development of sericulture industry in the region.

Lastly, I congratulate the scientists, technical and administrative personnel of the Institute and nested units for their commendable achievements on the set RFD targets and valuable contributions made for the benefit of the sericulture industry.


(Dr. S. Nirmal Kumar)
Director



निदेशक का संदेश



केन्द्रीय रेशम उत्पादन अनुसंधान व प्रशिक्षण संस्थान, बहरमपुर आई एस ओ 9001:2008 मानक की मान्यता से दिनांक 17 जनवरी, 2013 को अधिकृत किया गया है। शहतूत सुधार एवं उत्पादकता के अधीन संवर्धन के द्रुत प्रणाली के तौर पर प्रयोगशाला में शहतूत का पुर्नजनन, प्रजनन के लिए अनुकूल जनकों का चयन, शीघ्र मुकुलन तथा विलम्बित पतझड़ वाले जननद्रव्य एक्सेसनों की पहचान, निम्न तापक्रम प्रतिबल सहिष्णु शहतूत का विकास, पार्थिव (टैरेस्ट्रियल) कार्बन पृथक्कीकरण, शहतूत कृषि हेतु अल्प लागत वाली मशीन का विकास, पौध वृद्धि नियामक का वैधीकरण, शहतूत रोग व पीड़कों के पारिस्थिकी-मित्र प्रबंधन समेत पूर्वसंसूचना मॉडल का विकास तथा शहतूत के लिए अखिल भारतीय समन्वित परीक्षण वर्ष के दौरान अनुसंधान के प्रमुख क्षेत्र थे।

रेशमकीट पर किए गए अनुसंधान से आण्विक आई . डी. की संस्थापना, वृहत पैमाने पर क्षेत्र परीक्षण द्वारा उपयुक्त रेशमकीट संकरों की पहचान, अभिग्रहण हेतु संकरों के प्राधिकोत्तर परीक्षण, नए रेशमकीट संस्तर रोगाणुनाशी की लोकप्रियता तथा पश्चिम बंगाल में द्विप्रज बीज फसलों के लिए अनुकूल ऋतु की सफल पहचान भी की गई।

मानव संसाधन विकास के लिए प्रशिक्षण को एक साधन के तौर पर अपनाते हुए 259 व्यक्तियों को विभिन्न प्रशिक्षण कार्यक्रमों के माध्यम से समर्थ बनाया गया। इसके अतिरिक्त, रेशम कृषि की विभिन्न क्रिया-कलापों पर कृषकों/ सहभागियों को प्रशिक्षण प्रदान किया गया। विस्तार की दिशा में, 19852 कृषकों/ स्टेकहोल्डर निदर्शित, प्रशिक्षित किए गए तथा उन्हें संस्थान द्वारा विकसित उन्नत रेशम कृषि प्रौद्योगिकियों से अवगत कराया गया।

अवधि के दौरान, संस्थान की अनुसंधानात्मक व विकासात्मक उपलब्धियों की स्वीकृति के तौर पर 63 शोध पत्रों तथा 33 सारांशों को राष्ट्रीय एवं अंतरराष्ट्रीय ख्याति प्राप्त जर्नलों में प्रकाशित करने के अलावा 11 पुस्तकें, 11 प्रशिक्षण/विस्तार मैनुअल, 8 ब्रोचर, 5 तकनीकी बुलेटिन, 3 पुस्तिका, 3 लिफलेट, 7 पैम्फलेट, 57 तकनीकी प्रतिवेदनों/ रेशम सारांशों/ प्रतिवेदनों तथा लोकप्रिय लेखों एवं संस्थान के अर्धवार्षिक न्यूज बुलेटिन न्यूज एण्ड व्यूज का प्रकाशन अनुसंधानात्मक व विकासात्मक उपलब्धियों/प्रौद्योगिकियों पर वैज्ञानिकों, शोधकर्ता, स्टेकहोल्डर्स के ज्ञान को अद्यतन करने हेतु किया गया।

संस्थान की आंतरिक राजभाषा कार्यान्वयन समिति (रा . भा. का. स.) तथा नगर राजभाषा कार्यान्वयन समिति (नराकास) की बैठकें नियमित रूप से आयोजित कर राजभाषा नीति का सम्यक व सर्वोत्तम कार्यान्वयन इस संस्थान और नगर स्तर पर सुनिश्चित किया गया है। इसके अलावा, प्रशासन व तकनीकी दोनों संवर्ग के लिए 3 हिन्दी कार्यशालाओं का आयोजन तथा राजभाषा हिन्दी को समर्पित अर्धवार्षिक हिन्दी पत्रिका “रेशम दर्शन” का भी प्रकाशन किया गया।

ॐ श्री गणेशाय नमः
(डॉ. बी. बी. बिन्दू)
निदेशक



DIRECTOR'S MESSAGE




The CSR&TI, Berhampore has been accredited with **ISO 9001:2008** standards certification on 17th January, 2013. During the year, *in vitro* regeneration of mulberry as faster method of propagation, screening of suitable parents for breeding, identification of early sprouting and late senescent germplasm accessions, development of low temperature stress tolerant mulberry, terrestrial carbon sequestration, development of low cost machine for mulberry cultivation, validation of plant growth promoters, development of eco-friendly management of mulberry diseases and pests along with forewarning models and All India Coordinated trial for mulberry were the major thrust areas of research under the mulberry improvement and productivity.

Research conducted on silkworm has come out with the establishment of molecular IDs, identification of suitable silkworm hybrids through large scale field testing, post authorization trials of hybrids for adoption, popularization of new silkworm bed disinfectant and also successfully identified the suitable seasons for bivoltine seed crops in West Bengal.

Training has been taken as tool for HRD and 259 persons were empowered through various training programmes besides, training imparted to the farmers/ participants on different activities of sericulture. In Extension front, 19852 farmers / seri-stakeholders were demonstrated, trained and made aware on the improved sericulture technologies developed by the Institute.

During the period, 63 research papers and 33 abstracts were published in the journals of National and International repute as recognition of R&D achievements of the Institute, besides, 11 books, 11 Training/ Extension manuals, 8 brochures, 5 technical bulletins, 3 booklets, 3 leaflet, 7 pamphlets, 57 technical reports/ silk briefs/ reports and 7 popular articles and the Institute's half-yearly news bulletin 'News & Views' were released for the scientists, researchers, stakeholders for updating the knowledge on R&D achievements/ technologies on sericulture.

Official Language Policy was implemented organizing Internal Official Language Implementation Committee (OLIC) and Town Official Language Implementation Committee (TOLIC) meetings and excellent implementation of Official Language in works. Besides, 3 Hindi workshops both for administration and Technical cadres were organized and published half yearly Institute's Raj Bhasha (Hindi) Magazine "**Resham Darshan**".


(Dr. B. B. Bindroo)
Director

1. कार्यकारी सारांश

संस्थान की वर्ष 2012-13 की विशिष्ट उपलब्धियों तथा मुख्य अनुसंधान और विकास गतिविधियाँ निम्नवत हैं:

शहतूत उत्पादकता सुधार:

- ❖ शहतूत जीनप्रारूपों के प्रयोगशाला में म्यूटाजेनेसिस और पुनर्जनन हेतु प्रभावशाली प्रोटोकॉल विकसित किया गया है।
- ❖ अधि-उत्पादक शहतूत के विकास हेतु मार्कर्स के तौर पर कार्याकीय वृद्धि प्रचाल का उपयोग कर प्रत्येक छह एकलिंगाश्रयी मादा व नर जनक की पहचान संकरण हेतु की गई।
- ❖ 76 (विदेशज: 25 व देशज: 51) जननद्रव्यों एवं 73 सर्वोत्कृष्ट शहतूत एक्ससनों में से बोगुरा-4, कोलिठा-3 तथा सी-1726 व एस-1622 की पहचान शीघ्र मुकुलित तथा एम. रोटुनाडलोबा स्थानिक मैसूर व सी- 1540 व एस- 1622 को क्रमशः देशज, विदेश व सर्वोत्कृष्ट शहतूत एक्ससनों में विलम्ब से पतझड़ वाले एक्ससनों के रूप में की गई।
- ❖ शीत ऋतु (फरवरी - नवम्बर) के दौरान पादप वृद्धि विनियामक संयोजक (बेनेजाइल एडेनाइन पोटेशियम क्लोराइड) के पर्णाय अनुप्रयोग के वैधीकरण परीक्षण से वस्त्र निदेशालय (रेशम) फार्म, पश्चिम बंगाल सरकार के पाँच कृषकों के प्रक्षेत्र में नियंत्रण (S-1635) की अपेक्षा 29.2% की वृद्धि पर्ण उपज में दर्ज की गई।
- ❖ उप-उष्णकटिबंधी समतल भूमि के लिए निम्न प्रतिबल सहिष्णु शहतूत जीनप्रारूपों के विकास हेतु 30 संततियों का चयन शीत पर्ण उपज, वैद्युतिक संचालकता (ई सी) व नाइट्रेट उपचायक संक्रिया (एन आर ए) के आधार पर प्राथमिक उपज परीक्षण के अधीन आगे के परीक्षण के लिए किया गया है।
- ❖ पूर्वी व उत्तर-पूर्वी क्षेत्रों में 8 परीक्षण केन्द्रों में ए. आई. सी. ई. एम. कार्यक्रम (चरण-III) का आयोजन किया गया ; पौधरोपण संस्थापन अवस्था के अधीन है।



- ❖ “उत्कृष्ट शहतूत के सतत अधि-उत्पादकता के लिए पार्थिव कार्बन पृथक्करण” पर किए गए परीक्षण के प्रारंभिक वर्ष से यह पाया गया कि विविध खेती पद्धति (S-1635) में शहतूत प्रति हेक्टर 5.4 से 6.6 मी.टन/ वर्ष कार्बन अभिग्रहण कर सकता है।
- ❖ मूल बीज फार्म, कर्णसुवर्ण, बांगुरिया और वस्त्र निदेशालय (रेशम), आखेरीघाटा में युग्मित कतार पौधरोपण [(150 सेमी + 90 सेमी) X 60 सेमी के अंतराल] पर वैधीकरण परीक्षण से 60 सेमी X 60 सेमी पौधरोपण के समान शहतूत पर्ण उपज दर्ज की गई। तथापि, युग्मित कतार पौधरोपण के अंतर्गत बहुप्रज एवं द्विप्रज में नियंत्रण की अपेक्षा कोसा उपज में क्रमशः 13-19%, 12% की महत्वपूर्ण वृद्धि दर्ज की गई।

शहतूत संरक्षण:

- ❖ पूर्वी और उत्तर-पूर्वी भारत के विभिन्न स्थानों के लिए पीड़क प्रबंधन पैकेज सहित रोग कैलेंडर, रोग प्रचण्डता अर्थात मौसम विज्ञान जल, वायु पर कृषकों के उपयोग हेतु डाटा बेस विकसित किए गए।
- ❖ शहतूत पत्तियों को संक्रमित करने वाली इंडोफाईटिक फफूँद (*एकरेमोनियम रोसिओग्रिसियम*) की पहचान कर सर्वप्रथम आईजॉल से इसकी रिपोर्ट की गई।
- ❖ *सिमनस पेलीडिकोली* (मूलसेंट), पिंग मिली बग के एक परभक्षी *मेकोनेलिलोकस हिरसुटस* (ग्रीन) की जैविकी व अंशन क्षमता का अध्ययन पारिस्थितिकी-मित्र प्रबंधन के रूप में किया गया। परभक्षी अपना जीवन चक्र 23 दिन में संपूर्ण करता है।
- ❖ रासायनिक पीड़कनाशी के प्रक्षेत्र मूल्यांकन के अंतर्गत थायमेथोक्वम (0.015%) को छिड़काव के 15 दिन के भीतर 93% तक श्वेत मक्खी जीवसंख्या के उन्मूलन में प्रभावी पाया गया और इससे पर्ण उपज में 27% की वृद्धि देखी गई।



रेशमकीट सुधार एवं उत्पादकता:

- ❖ तीन बहु x द्वि संकरों M6DP6 x D6PN, M6DP(C) x SK4C एवं (D6PN x SK4C) तथा एक द्वि x द्वि संकर D6PN x SK46, M6DP(C) x SK4C के बृहत प्रक्षेत्र परीक्षण किया गया जिसमें M6DP(C) x SK4C में 67.5 किग्रा, M6DP(C) x (D6PN x SK4C) में 65.8 किग्रा तथा M6DP(C) x D6PN में 65.7 किग्रा की दर से क्रमशः 19.6% नियंत्रक N x NB4D2 के सापेक्ष में दर्ज की गई। जबकि नियंत्रित द्वि x द्वि संकर, NBD18 x P5 (66.5 किग्रा/100 रोमुच) की अपेक्षा D6PN x SK46 में 8% की सुधार दर्ज की गई।
- ❖ पूर्वी एवं उत्तर-पूर्वी क्षेत्रों में कृषकों के स्तर पर रेशमकीट संकरों के प्राधिकोत्तर परीक्षण के अधीन 2,50,269 रोमुच का कीटपालन किया गया। प्रतिकूल मौसम के दौरान N+p x M.Con4, M.Con1 x M.Con4 व M.Con4 x B.Con4 के कीटपालन से रुलिंग संकर [NxM12(डब्ल्यू)] के 26.6 किग्रा/100 रोमुच की अपेक्षा कोसा उपज 35–45 किग्रा/100 रोमुच पाया गया। अनुकूल मौसम के दौरान M.Con1 x M.Con4, M.Con4 x B.Con4, B.Con1 x B.Con4 के कीटपालन से कोसा उपज क्रमशः 38–42 किग्रा, 54–60 किग्रा एवं 52–64 किग्रा कोसा/100 रोमुच दर्ज की गई।
- ❖ एम एस आर ए पी के अंतर्गत द्विप्रज एवं बहु x द्वि संकरों का परीक्षण क्रमशः 4 व 5 केन्द्रों में किया गया। कीटपालन आंकड़ों के आधार पर निस्तरी x (SK6 x SK7) की तुलना में बहु x द्वि संकरों में M6DP6 x SK4C प्रथम दर्जा का था। तथापि, द्वि x द्वि संकर में (CSR50 x CSR52) तथा (CSR51 x CSR53) की अपेक्षा CSR50 x CSR51 एवं CSR28DR x CSR21DR में प्रथम दर्जा के रूप में पाया गया।
- ❖ शहतूत रेशमकीट नस्लों (बॉम्बिक्स मोरी एल) के लिए आण्विक आई डी के संस्थापन हेतु किए गए अध्ययन के अंतर्गत 12 रेशमकीट प्रभेद के डिंभकीय उत्तकों को संग्रहित कर लिंग गुणसूत्र आधारित एल जी आई -3 डी. एन. ए. संबंधी अंश की जाँच से प्योर मैसूर नस्ल के डिंभकीय मार्किंग लिंग संयोजक के बीच बहुरूपता देखी गई।



- ❖ पश्चिम बंगाल के जलवायु के अधीन सभी ऋतुओं में विशेषतया द्विप्रज बीज फसल की संभावना व व्यवहार्यता को ढूँढ निकाला गया तथा तीन ग्रामों में से कुल नौ मॉडल द्विप्रज बीज कीटपालकों की पहचान अनुवर्तन हेतु की गई।

रेशमकीट संरक्षण:

- ❖ सेरिसिलिन, एक नए रेशमकीट संस्तर विसंक्रमाक के प्रभाव की जाँच 638 कृषकों के प्रक्षेत्र में 65,000 रोमुच का कीटपालन कर की गई और इससे नियंत्रण की अपेक्षा कोसा उपज 3-4.2 किग्रा कोसा/100 रोमुच के साथ 12% की वृद्धि दर्ज की गई। लाभ अनुपात 6:4:1 है। सूत्रीकरण एन आर डी सी, नई दिल्ली के माध्यम से एकस्व व वाणिज्यिकरण के प्रक्रियाधीन है।

लागत में कटौती:

- ❖ एक E³WM (c) LM (सामान्य फलोत्पादक मितव्ययी परिस्थितिकी - मित्र खर-पतवार मूवर सह लान-मूवर) का सफल विकास किया गया, जिसकी क्षमता सूची 20 है।

प्रौद्योगिकी का हस्तांतरण:

संस्थानिक ग्राम संबद्ध कार्यक्रम (आई वी एल पी):

- ❖ संस्थानिक ग्राम संबद्ध योजना कार्यक्रम (चरण-III), के अधीन 1020 (सिंचित 270 व वर्षाश्रित 750) कृषकों का लाया गया एवं शहतूत पर्ण उपज एवं कोसा उत्पादन में वृद्धि दर्ज की गई:

शहतूत:

- ❖ सिंचित अवस्था के अधीन पर्ण उपज में नियंत्रण 35.5 मी.टन/हे/वर्ष की तुलना में 12.2% की वृद्धि दर्ज की गई जबकि वर्षाश्रित अवस्था में नियंत्रण की अपेक्षा (11.15 मी. टन/हे/वर्ष) 19.6% की वृद्धि देखी गई।

रेशमकीट:

- ❖ सिंचित अवस्था के अधीन बहुप्रज x द्विप्रज के 115450 रोग मुक्त चकत्ते और बहुप्रज x बहुप्रज के 31,000 रोग मुक्त चकत्ते के कीटपालन से नियंत्रण



की अपेक्षा बहुप्रज x द्विप्रज के (42.2 कि.ग्रा) तथा बहुप्रज x बहुप्रज में 27.3 किग्रा/100 रोग मुक्त चकत्तों की औसत उपज के साथ क्रमशः 11.8% एवं 10% की वृद्धि दर्ज की गई।

- ❖ वर्षाश्रित अवस्था के अधीन द्विप्रज x द्विप्रज के कुल 41357 रोग मुक्त चकत्ते, बहुप्रज x द्विप्रज के 38172 रोग मुक्त चकत्ते एवं बहुप्रज x बहुप्रज के 18100 रोग मुक्त चकत्तों का कीटपालन किया गया। नियंत्रण की अपेक्षा द्विप्रज x द्विप्रज में 41 किग्रा/100 रोमुच एवं बहुप्रज x बहुप्रज में 25.9 किग्रा/100 रोमुच की औसत कोसा उपज सहित 16.9%, 10.8%, 9.7% की वृद्धि क्रमशः दर्ज की गई।

मानव संसाधन विकास (एचआरडी):

- ❖ रेशम उत्पादन के निरंतर विकास की दृष्टि से प्रौद्योगिकी के हस्तान्तरण हेतु विविध मानव संसाधन विकास कार्यक्रम आयोजित कर अवधि के दौरान कुल 259 उम्मीदवार [(पीजीडीएस : 47, प्रबंधन विकास कार्यक्रम: 21, निपुणता अद्यतन कार्यक्रम: 96, आईएसडीएस: 63 एवं तदर्थ: 32)] प्रशिक्षित किए गए। साथ ही रेशम कृषि के विभिन्न प्रक्रियाओं यथा शहतूत कृषि, संस्थान द्वारा विकसित रेशमकीट पालन प्रौद्योगिकियों, रोग एवं पीड़क प्रबंधन आदि पर कृषकों/प्रतिभागियों को नियमित प्रशिक्षण प्रदान किया गया।

विस्तार संसूचना कार्यक्रम:

संस्थान द्वारा विकसित प्रौद्योगिकियों के प्रसार तथा कृषकों को शहतूत कृषि एवं रेशम कीटपालन प्रक्रिया/तकनीकों से प्रशिक्षित करने के लिए संस्थान द्वारा निम्नलिखित कार्यक्रम आयोजित किए गए जिसके अंतर्गत कृषि मेलों, प्रक्षेत्र दिवस, जागरूकता कार्यक्रम, दृश्य श्रव्य कार्यक्रम एवं प्रदर्शनी में आकर 19852 से अधिक कृषकों / सेरी-स्टेकहोल्डर्स ने विविध रेशम प्रौद्योगिकियों पर ज्ञान प्राप्त किया।

क्र.सं.	आयोजित गतिविधि	कार्यक्रमों की संख्या (कृषकों)
1	रेशम कृषि मेला	5 (910)
2	श्रव्य- दृश्य कार्यक्रम	58 (2844)



3	प्रक्षेत्र दिवस	51 (2516)
4	प्रदर्शनी	59 (5710)
5	जागरूकता कार्यक्रम	75 (4278)
6	कृषक व प्रशिक्षक प्रशिक्षण कार्यक्रम	85 (3278)

प्रकाशन:

- ❖ संस्थान के नवीनतम अनुसंधान उपलब्धियों एवं विशिष्टताओं के बारे में जागरूकता के लिए अर्धवार्षिकी आर एंड डी, न्यूज बुलेटिन ‘न्यूज एंड व्यूज’ का प्रकाशन।
- ❖ राष्ट्रीय (34) तथा अंतर्राष्ट्रीय (27) जर्नलों/ संगोष्ठियां/ सिंफोजियम/सम्मेलनों में 66 (छियासठ) शोध पत्रों तथा 18 अनुसंधान सारांश प्रकाशित व प्रस्तुत किए गए।
- ❖ 4 पुस्तिकों 11 प्रशिक्षण/विस्तार मैनुअल, 8 ब्रोचर, 5 तकनीकी बुलेटिन, 3 पुस्तिकाओं, 3 लीफलेट व 7 पैंफलेट प्रकाशित किए गए।
- ❖ 41 तकनीकी रिपोर्ट / रेशम सारांश/रिपोर्ट एवं 7 लोकप्रिय लेखों का प्रकाशन किया गया।

राजभाषा कार्यान्वयन:

- ❖ संस्थान में राजभाषा कार्यान्वयन समिति की कुल 4 चार तथा नगर राजभाषा कार्यान्वयन समिति की 2 दो बैठकों के आयोजन के साथ-साथ तकनीकी एवं प्रशासनिक पदधारियों के लिए कुल 3 तीन हिन्दी कार्यशालाओं का भी आयोजन समय-समय पर किया गया।
- ❖ संस्थान की राजभाषा हिन्दी को समर्पित अर्धवार्षिकी “रेशम दर्शन” पत्रिका का प्रकाशन।

अन्य महत्वपूर्ण गतिविधियाँ:

- ❖ केरेउअवप्रसं, बहरमपुर संस्थान को आई एस ओ 9001:2008 मानक के तौर पर दिनांक 17 जनवरी, 2013 को मान्यता प्रदान की गई।



- ❖ संस्थान अपने अधीनस्थ क्षेत्रों के, अविके केन्द्रों, राष्ट्रीय रेशमकीट बीज संगठन, मालदा, व इसके संबंधित राज्य रेशम निदेशालयों के साथ दिनांक 17/05/2012 एवं 20/09 /2012 को एनआईसी मुर्शिदाबाद में दो विडिओं क्राफ़ेस का आयोजन किया गया।
- ❖ संस्थान में महात्मा गांधी राष्ट्रीय ग्रामीण रोजगार गारंटी योजना के अधीन विकासात्मक कार्यकलाप जारी है।

वाह्य निधिक परियोजनाएँ:

- ❖ डीबीटी निधिक: शहतूत के डीएनए मार्कर आधारित आनुवंशिक लिंकेज मैप का विकास एवं कृषकीय महत्वपूर्ण प्लांटा ट्रेट्स के लिए क्यूटियल विश्लेषण (सी सी एम बी, हैदराबाद के साथ सहयोग)।
- ❖ डीबीटी निधिक पीआईजी-3441 : शहतूत चूर्णिल असिता प्रतिरोध (फाइलेक्टिनिया कोरिलिया) के स्कार मार्कर्स का विकास, वैद्यीकरण व उपयोग (सी सी एम बी, हैदराबाद के साथ सहयोग)।
- ❖ डीएसटी, पश्चिम बंगाल निधिक: पश्चिम बंगाल में द्विप्रज बीज कोसा के संवर्धित उत्पादन हेतु कृषक स्तर पर शहतूत बीज कोसा के परिप्रेक्ष्य में परियोजना (वस्त्र निदेशालय (रेशम), पश्चिम बंगाल के साथ सहयोग)।

क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्रों की उपलब्धियाँ:

क्षेत्रों के, कलिम्पोंग (पश्चिम बंगाल) :

- ❖ कलिम्पोंग के रेशम कृषकों के प्रक्षेत्र में मृदा उर्वरता स्थिति पर मूल्यांकन अध्ययन के अंतर्गत मृदा की प्रकृति हल्का से कठोर अम्लीय, मध्यम से उच्च जैव-कार्बन का अंश तथा नाइट्रोजन पाया गया। जबकि, मृदा में फास्फोरस एवं सल्फर की मात्रा निम्न से मध्यम पाई गई। मृदा सुधार के लिए अपेक्षित चूना का निर्धारण 0.6-1.5 मी टन/हे निर्धारित किया गया है।
- ❖ शहतूत द्विप्रज रेशमकीट प्रजाति प्राधिकरण कार्यक्रम (एम एस आर ए पी) के अधीन युग्म संकर (CSR52 x CSR50) x (CSR52 x CSR50) को 10 व्यस्क डिम्बक, एकल कोसा वजन व एकल कवच भार की तुलना में अन्य संकरों से



बेहतर पाया गया। तथापि, NK2 x HND संकर को कोसा उपज (60.8 किग्रा/100 रोमुच) की तुलना में बेहतर पाया गया।

- ❖ शहतूत परियोजनाएं/ कार्यक्रम नामतः पी पी एस-3435: पूर्वी तथा उत्तर-पूर्वी भारत में उत्कृष्ट शहतूत के सतत अधिक उत्पादनशीलता के लिए सूक्ष्म पोषक पर अध्ययन, सी एस एस-2107: शहतूत रोगों के पूर्वानुमान तथा पूर्व संसूचना प्रणाली का विकास, ए आई ई -3454: विभिन्न कृषकीय जलवायु अवस्था के अधीन सर्वोत्कृष्ट द्विप्रज रेशमकीट जननद्रव्य का मूल्यांकन : अखिल भारतीय रेशमकीट जननद्रव्य मूल्यांकन कार्यक्रम (चरण-II), बी पी आर(पी) 021: शहतूत पीड़कों के लिए मौसम आधारित पूर्वानुमान मॉडल का विकास, ए आई सी ई एम (चरण-III) व बी एम ओ(पी) -003: संस्थानिक ग्राम संबद्ध कार्यक्रम, आई वी एल पी (चरण-III) के अलावे दो निजी अनुसंधान कार्यक्रमों [बी-के पी जी(पी)-015 तथा बी के पी जी (पी)-016] को क्रियान्वित करने के अतिरिक्त निर्धारित अन्य विस्तार कार्यक्रमों को पूरा किया।
- ❖ मूंगा रेशमकीट बीज कार्यालय, गुवाहाटी के सहयोग से मूंगा विस्तार कार्यक्रम बी के पी जी (पी) -006] को क्रियान्वित किया गया।

क्षेत्रेउअके,कोरापुट (ओडिशा):

- ❖ दो सहयोगी परियोजनाएं शीर्षक पी पी एस-3435: पूर्वी तथा उत्तर पूर्वी भारत में उत्कृष्ट शहतूत के सतत अधिक उत्पादनशीलता के लिए सूक्ष्मपोषक पर अध्ययन, सी एस ए-2107: शहतूती रोगों के लिए पूर्वानुमान तथा पूर्व संसूचना प्रणाली का विकास एवं पांच कार्यक्रमों, वी पी आर (पी)- 021: शहतूत पीड़कों के लिए मौसम-आधारित पूर्वानुमान मॉडल का विकास, बी एम ओ (पी)-003: संस्थानिक ग्राम संबद्ध कार्यक्रम, आई वी एल पी (चरण-III), ए आई सी ई एम (चरण-III), शहतूत रेशम कीट प्रजाति प्राधिकरण कार्यक्रम (एम एस आर ए पी-VIII) के अलावा दो अपने कार्यक्रमों बी-के पी टी (पी)-017: समुचित उर्वरक प्रबंधन के लिए कोरापुट के चयनित रेशम ग्राम में शहतूत उत्पादक मृदा की उर्वरता स्थिति का मूल्यांकन एवं शहतूत तथा रेशमकीट के रोगों व पीड़कों के



- सर्वेक्षण व निगरानी को क्रियान्वित करने के साथ ही साथ अन्य विस्तार कार्यक्रमों को पूरा किया।
- ❖ 6700 शहतूत पौध (S-1635) का संपोषण तथा आपूर्ति वस्त्र निदेशालय, ओडिशा को लक्ष्यांकित 10,000 पौध के अंतर्गत शहतूती एकड़ के संप्रसारण के लिए की गई तथा 3300 का उपयोग क्षेरेउअके के प्रक्षेत्रों में किया गया।
 - ❖ नये रेशमकीट संकरों (SK6 x SK7) के 870 रोमुच एवं M.Con4 x B.Con4 के 300 रोमुच के कुल 1170 रोग मुक्त चकत्तों को तैयार तथा इसकी आपूर्ति रेशम निदेशालय, ओडिशा तथा छत्तीसगढ़ को लोकप्रिय बनाने के लिए किया गया।
 - ❖ ओडिसा एवं छत्तीसगढ़ में 21895 रोग मुक्त चकत्तों के मॉनीटर द्विप्रज बीज कीटपालन (SK6 x SK7) द्वारा 5131 किग्रा (34,94,84 संख्यक) बीज कोसा का उत्पादन पश्चिम बंगाल के बीजागारों में आपूर्ति करने हेतु किया गया।

क्षेरेउअके, रांची झारखण्ड:

- ❖ बी-आर एन सी (वी पी)-007: वर्षाश्रित अवस्था के अधीन पोषक के पैकेज वैद्यूकरण परीक्षण के अंतर्गत पोषकों के पैकेजों के अनुप्रयोग से पर्ण उपज में 9.8% वृद्धि कृषक स्तर पर दर्ज की गई। मुख्य संस्थान के एक सहयोगी शीर्षक पी पी एस - 3435:पूर्वी तथा उत्तर -पूर्वी तथा उत्तर-पूर्वी भारत में उत्कृष्ट शहतूत के सतत् अधिक उत्पादकनशीलता के शिलिए सूक्ष्मपोषक पर अध्ययन तथा तीन कार्यक्रमों शहतूत (चरण-III) के लिए अखिल भारतीय समन्वित प्रायोगिक परीक्षण, बी एम ओ(पी)-003: संस्थानिक ग्राम संबद्ध कार्यक्रम (आई वी एल पी चरण-III) तथा शहतूत रेशमकीट प्रजाति प्राधिकरण कार्यक्रम, एम एस आर ए पी (चरण- VIII) के अलावे अपने दो कार्यक्रमों, बी-आर एन सी (पी)-018: समुचित उर्वरक प्रबंधन के लिए रांची के चयनित रेशम ग्राम में शहतूत उत्पादक मृदा की उर्वरता स्थिति का मूल्यांकन, बी-आर एन सी (आर-पी)-004 शहतूत तथा रेशमकीटों के रोगों व पीड़कों के सर्वेक्षण व



निगरानी को क्रियान्वित करने के साथ अन्य विस्तार कार्यक्रमों को पूरा किया।

- ❖ रांची, गुमला एवं लोहरदगा जिले में शहतूत कृषि के अधीन कुल 7.5 एकड़ नये प्रक्षेत्र कृषि के अधीन लाया गया।

क्षेत्रेउअके, जोरहाट (असम):

- ❖ सहयोगी परियोजनाएं/कार्यक्रम पी पी एस-3435:पूर्वी तथा उत्तर-पूर्वी भारत में उत्कृष्ट शहतूत के सतत अधिक उत्पादनशीलता के लिए सूक्ष्मपोषक पर अध्ययन, सी एस एस-2107: शहतूत रोगों के पूर्वानुमान तथा पूर्वसंसूचना प्रणाली का विकास, ए आई ई-3454: विविध कृषकीय जलवायु अवस्था (ए आई एम एस ई जी पी चरण-III) के अधीन सर्वोत्कृष्ट द्विप्रज रेशमकीट जननद्रव्य का विकास, बी पी आर (पी)-021 शहतूत पीड़कों के लिए मौसम-आधारित पूर्वानुमान मॉडल का विकास, ए. आई. सी. ई. एम. (चरण-III) तथा बी. एम. ओ. (पी)-003 संस्थानिक ग्राम संबद्ध कार्यक्रम आई वी एल पी (चरण-III) के अलावे एक अनुसंधान परियोजना व दो अपने अनुसंधान कार्यक्रमों का क्रियान्वयन, एम ओ ई-3459: रेशम कृषि में उपज अंतराल- भारत के उत्तर-पूर्वी क्षेत्रों में एक अध्ययन तथा बी-जे आर एच (पी) -019: समुचित उर्वरक प्रबंधन के लिए जोरहाट के चयनित रेशम ग्राम में शहतूत उत्पादक मृदा के उर्वरता की स्थिति के मूल्यांकन के साथ अन्य निर्धारित विस्तार कार्यक्रमों को पूरा किया।
- ❖ शहतूत पर श्वेत मक्खी के प्रबंधन हेतु काकसीनिल्ड परभक्षी (सियमनस पोस्टीकेलिस) का जैविकी व अंशान क्षमता का अध्ययन किया गया।



1. EXECUTIVE SUMMARY

Salient findings and a brief highlight of Research and Development activities for the year 2012-13.

MULBERRY IMPROVEMENT AND PRODUCTIVITY

- ❖ For *in vitro* mutagenesis and regeneration of mulberry genotypes, a novel protocol has been developed.
- ❖ Six each of dioecious female and male parents have been identified for crossing for development of high yielding mulberry using physiological growth parameters as markers for selection.
- ❖ Among 76 (exotic: 25 and indigenous: 51) germplasm and 73 elite mulberry accessions, Bogura-4, Kolitha-3 and C-1726 & S-1622 were identified as early sprouters (10-12 days), while, *M. rotundiloba*, Mysore local and C-1540 & S-1622 were late senescent accessions among exotic, indigenous and elite accessions respectively.
- ❖ Validation trial of foliar application of Plant growth regulator combination (Benzyl adenine + KCl) in winter season (February - November) increased mulberry leaf yield to the tune of 29.2% over the control (S-1635) at five DoT (Seri) farms, Govt. of West Bengal.
- ❖ For developing low temperature stress tolerant mulberry genotypes for sub-tropical plains, 30 progenies have been selected based on winter leaf yield, Electrical Conductivity (EC) and Nitrate reductase activity (NRA) for further testing under Primary Yield Trial.
- ❖ The AICEM (Phase-III) programme has been conducted at 8 test centres in Eastern & North-Eastern region; plantation is under establishment stage.
- ❖ In “Terrestrial carbon sequestration for sustained high productivity of quality mulberry” study, initial year of experimentation revealed 5.4 to 6.6 mt/year carbon capturing efficiency (CCE) by mulberry (S-1635) plantation of one hectare land growing under varying farming practices.
- ❖ Validation trial of Paired Row plantation [(150 cm + 90 cm) x 60 cm spacing] conducted at BSF Karnasubarna, BSF, Banguria and DoT (Seri), Akherighata registered mulberry leaf yield *at par* with 60 cm x 60 cm plantation. However, cocoon yield was significantly higher with Paired row plantation to the tune of 13-19 % in multivoltine and 12 % in bivoltine against control.

MULBERRY PROTECTION

- ❖ Database on disease severity, disease calendar *vis-a-vis* prevailing meteorological conditions at different locations of Eastern and North Eastern India along with disease management packages developed for farmers use.



- ❖ One endophytic fungus (*Acremonium roseogriseum*) infecting mulberry leaves has been identified and reported first time from Aizawl.
- ❖ Biology and feeding efficacy of *Scymnus pallidicollis* (Mulsant) a predator of pink mealy bug, *Maconellicoccus hirsutus* (Green) have been studied as eco-friendly management. The life cycle of the predator completes in 23 days.
- ❖ Field evaluation of the chemical pesticide, Thiamethoxam (0.015%) was found effective in suppressing the whitefly population to the tune of 93% within 15 days of spray and thereby leaf yield gain of 27%.

SILKWORM IMPROVEMENT AND PRODUCTIVITY

- ❖ Large scale field testing of three multi x bi hybrids M6DPC x D6PN, M6DP(C) x SK4C and M6DPC x (D6PN x SK4C) and one Bi x Bi hybrid D6PN x SK4C showed cocoon yield/ 100 dfls of 67.4 kg in M6DP(C) x SK4C followed by 65.8 kg in M6DP(C) x (D6PN x SK4C) and 65.7 kg in M6DP(C) x D6PN with 19.6% yield gain over N x NB4D2 (control), while, in Bi x Bi hybrid, D6PN x SK4C showed 8% improvement over the control NB18 x P5 (66.5 kg/100 dfls).
- ❖ Under Post authorization trial of silkworm hybrids at farmers' level in Eastern & North-Eastern region, 250269 dfls were reared. During unfavourable seasons, N+p x M. Con4, M. Con1 x M. Con4 and M. Con4 x B. Con4 showed 35-45 kg/100 dfls cocoon yield against 26.6 kg/100 dfls in ruling hybrid [N x M12 (W)]. In favourable season, M. Con1 x M. Con4, M. Con4 x B. Con4, B. Con1 x B. Con4 yielded 38-42 kg, 54-60 kg and 52-64 kg cocoons/100 dfls, respectively.
- ❖ Under MSRAP, Bivoltine and Multi x Bi hybrids were tested in 4 test centres and 5 test centres, respectively. Based on rearing data, among the Multi x Bi hybrid M6DPC x SK4C ranked first followed by Nistari x (SK6 x SK7). However, in Bi x Bi hybrid, (CSR50 x CSR52) x (CSR51 x CSR53) ranked first followed by CSR50 x CSR51 and CSR28DR x CSR21DR.
- ❖ Study conducted on "Establishment of molecular IDs for the mulberry silkworm breeds (*Bombyx mori* L.)", larval tissues of 12 silkworm strains were collected and screened with SNPs pertaining to LG1-3 DNA fragments pertaining sex chromosome showed polymorphism between sex-limited larval marking breed of Pure Mysore.
- ❖ The possibility and feasibility of raising exclusively the bivoltines seed crops in all the seasons under West Bengal conditions were deciphered and a total of nine model bivoltine seed rearers amongst the three villages have been identified for follow up.

SILKWORM PROTECTION

- ❖ The effect of new silkworm bed disinfectant, Sericillin tested at 638 farmers with rearing of 65,000 dfls, yield was increased @3-4.2 kg cocoons /100 dfls with 12%



yield gain over control. Benefit – Cost ratio is 6.4:1. The formulation is under patenting and commercialization through NRDC, New Delhi.

COST REDUCTION

- ❖ Successfully developed an E³ WM (c) LM (simple Efficient Economic Eco-friendly Weed Mower cum Lawn Mower) with an efficiency index of 20.

TECHNOLOGY TRANSFER

Institute Village Linkage Programme (IVLP):

Under IVLP programme (Phase-III), 1020 (irrigated 270 and rainfed 750) farmers were covered and mulberry leaf and cocoon yield have been increased:

- ❖ **Mulberry:** In irrigated condition, leaf yield was increased by 12.2% against 35.5 mt/ ha/year in control, while, in rainfed condition, the increment was 19.6 % over the control (11.15 mt/ha/yr).
- ❖ **Silkworm:** In irrigated condition, rearing of 115450 dfls of Multi x Bi and 31000 dfls of Multi x Multi recorded an average yield of 42.2 kg in Multi x Bi and 27.3 kg in Multi x Multi, per 100 dfls with yield gain of 11.8% and 10% respectively over the controls. Under rainfed condition, a total of 41357 dfls of Bi x Bi, 38172 dfls of Multi x Bi and 18100 dfls of Multi x Multi were reared. Average cocoon yield/100 dfls for Bi x Bi was 43.7 kg, 41 kg/100 dfls in Multi x Bi and 25.9 kg/100 dfls in Multi x Multi with 16.9 %, 10.8 % and 7% gains respectively over the control.

HUMAN RESOURCE DEVELOPMENT (HRD):

- ❖ Various HRD programmes were organized for Transfer of Technology in view of sustainable development of sericulture. During the period, a total of 259 candidates were trained [PGDS: 47, Management Dev. Prog.: 21, Skill Updation Prog.: 96, ISDS: 63, Ad-hoc: 32]. Regular training was imparted to the farmers/ participants on different activities of sericulture, such as, mulberry cultivation, silkworm rearing technologies, disease & pest management etc. developed by the Institute.

EXTENSION COMMUNICATION PROGRAMMES:

- ❖ To disseminate technologies, educate and train the farmers on different aspects of improved mulberry cultivation and silkworm rearing practices/technologies developed by the Institute, different extension prog. were taken up and more than 19852 farmers / seri-stakeholders participated in the Krishi Melas, Field Days, Awareness & A-V Prog., visited exhibition and gained knowledge on different improved sericulture technologies.



Sl. No.	Events	No. of events (farmers)
1	Resham Krishi Mela	5 (910)
2	Audio-visual prog.	58 (2844)
3	Field Day	51 (2516)
4	Exhibition	59 (5710)
5	Awareness programme	75 (4278)
6	Farmers' & Trainers' Training prog.	85 (3278)

PUBLICATION

- ❖ Published half-yearly R&D news bulletin “**NEWS & VIEWS**” for awareness about the latest information on research findings and achievements of the Institute.
- ❖ 63 research papers and 33 research abstracts were published in the National & International Journals/ presented in Seminars/ Symposium/ Conferences.
- ❖ Published 11 Books, 11 Training/ Extension manuals, 8 brochures, 5 Technical bulletins, 3 Booklets, 3 Leaflet and 7 Pamphlets. Published 57 Technical Reports/ Silk briefs/ reports and 7 Popular articles.

OFFICIAL LANGUAGE IMPLEMENTATION

- ❖ Four Internal Official Language Implementation Committee (OLIC) meetings and two Town Official Language Implementation Committee (TOLIC) were conducted at the Institute as per schedule besides organizing 3 Hindi workshops both for administration and Technical cadres. Published half yearly Institute's Raj Bhasha (Hindi) Magazine “**Resham Darshan**”.

OTHER SIGNIFICANT ACTIVITIES

- ❖ CSR&TI, Berhampore has been recognized as **ISO 9001:2008** standard Institute on 17th January, 2013.
- ❖ Two Video Conferences held on 17/05/2012 and 20/09/2012 at NIC, Murshidabad with its nested RSRs, RECs, NSSO, Malda and DoS of respective states.
- ❖ Developmental activities at the Institute under MG-NREGA were continued.

EXTERNALLY FUNDED PROJECTS

- ❖ **DBT funded:** Development of DNA marker based genetic linkage map of mulberry and QTL analysis for agronomically important *planta* traits (Collaboration with CCMB, Hyderabad).
- ❖ **DBT funded PIG-3441:** Development, validation and utilization of SCAR marker(s) for powdery mildew (*Phyllactinia corylea*) resistance in mulberry (Collaboration with CCMB, Hyderabad).



- ❖ **DST, West Bengal funded:** Improvement of mulberry seed cocoon production at farmers' level with special reference to Bivoltine seed cocoon in West Bengal (Collaboration with DoT (Seri), West Bengal).

ACHIEVEMENTS AT RSRSS

RSRS, Kalimpong (West Bengal):

- ❖ Assessment study on soil fertility status at seri-farmers of Kalimpong hills showed slight to strong acidic nature of soil, medium to high organic carbon and available nitrogen content whereas low to medium phosphorus and sulphur contents. For soil amelioration, requirement of lime has been assessed as 0.6- 1.5 mt/ ha.
- ❖ Under the Mulberry Bivoltine Silkworm Race Authorization Prog. (MSRAP) double hybrid (CSR52 x CSR50) x (CSR51 x CSR52) performed better than other hybrids in respect of wt. of 10 matured larvae, single cocoon wt. and single shell wt. However, NK2 x HND hybrid performed better in respect of cocoon yield (60.8 kg/100 dfls.)
- ❖ Implemented the collaborative projects/ prog., PPS-3435: Studies on micronutrients for sustained high productivity of quality mulberry in Eastern and North-Eastern India, CSS-2107: Development of forecasting and forewarning system of mulberry diseases, AIE-3454: Evaluation of elite bivoltine silkworm germplasm under different agro-climatic conditions: AIMSGEP (Phase-II), BPR(P)021: Development of weather-based forecasting models for mulberry pests, AICEM (Phase-III) and BMO(P)-003: IVLP (Phase-III), besides, implementing two own prog. [B-KPG(P)-015 and B-KPG(P)-016] along with taking up other routine extension activities.
- ❖ Implemented the Muga Augmentation Prog. [B-KPG(P)-006] in collaboration with MSSO, Guwahati.

RSRS, Koraput (Odisha):

- ❖ Implemented two collaborative projects entitled PPS-3435: Studies on micronutrients for sustained high productivity of quality mulberry in Eastern and North-Eastern India, CSS-2107: Development of forecasting and forewarning system of mulberry diseases; and five prog., BPR(P)-021: Development of weather based forecasting Models for mulberry pests, BMO(P)-003: IVLP (Phase-III), AICEM (Phase-III), MSRAP (Phase VIII), besides, implementing two own prog. B-KPT(P)-017: Assessment of fertility status of mulberry growing soils in selected seri-village of Koraput for appropriate fertilizer management and Survey and surveillance of diseases and pests of mulberry and silkworm along with routine extension activities.



- ❖ Raised and supplied 6700 mulberry saplings (S-1635) to DoS, Odisha for mulberry acreage expansion and 3300 utilized at RSRS farm against the target of 10,000 saplings.
- ❖ Monitored Bivoltine seed rearing of 21895 dfls (SK6 x SK7) in Odisha and Chhattisgarh, generated 5131 kg (3494850 Nos.) seed cocoons for supply to West Bengal grainages. A total of 1170 dfls of new silkworm hybrids (870 dfls of SK6 x SK7 and 300 dfls of M.Con4 x B.Con4) prepared and supplied to DoS, Odisha and Chhattisgarh for popularization.

RSRS, Ranchi (Jharkhand):

- ❖ Under B-RNC (VP) 007: Validation trial of package nutrient under rainfed condition, mulberry leaf yield increased by 9.8% with the application of package of nutrients at farmers' level.
- ❖ Implemented one collaborative project of Main Institute entitled PPS-3435: Studies on micronutrients for sustained high productivity of quality mulberry in Eastern and North-Eastern India and three prog., AICEM (Phase-III); BMO(P)-003: IVLP (Phase-III) and MSRAP (Phase-VIII) apart from two own prog., B-RNC(P)-018: Assessment of fertility status of mulberry growing soils in selected seri-village of Ranchi for appropriate fertilizer management, B-RNC(RP)-004: Survey and surveillance of diseases and pests of mulberry and silkworm and routine extension activities.
- ❖ A total of 7.5 acres of new area was brought under cultivation in Ranchi, Gumla and Lohardaga districts.

RSRS, Jorhat (Assam):

- ❖ Implemented the collaborative projects/ prog., PPS-3435: Studies on micronutrients for sustained high productivity of quality mulberry in Eastern and North-Eastern India, CSS-2107: Development of forecasting and forewarning system of mulberry diseases, AIE-3454: Evaluation of elite bivoltine silkworm germplasm under different agro-climatic conditions (AIMSGEP phase-II, BPR(P)-021: Development of weather-based forecasting models for mulberry pests, AICEM (Phase-III) and BMO(P)-003: IVLP (Phase-III), besides, implementing one research project and two own research prog., MOE-3459: Yield gap in mulberry sericulture - A study in North-Eastern region of India, and B-JRH(P)-019: Assessment of fertility status of mulberry growing soils in selected seri-village of Jorhat for appropriate fertilizer management along with taking up other routine extension activities.
- ❖ For management of whitefly on mulberry, the biology and feeding efficiency of the Coccinellid predator (*Scymnus posticalis*) have been studied.



2. INTRODUCTION

Central Sericultural Research and Training Institute is one of the oldest premier Sericulture Research and Training Institutes in the country. Since its establishment in the year 1943, the Institute has been rendering outstanding research, development, technical, technological, extension and service support through its four (4) Regional Sericultural Research Stations (RSRSs) at Kalimpong (W.B.), Koraput (Odisha), Ranchi (Jharkhand) and Jorhat (Assam) and 14 nested units i.e. 12 Research Extension Centers (RECs) at Kamnagar (Murshidabad) & Mothabari (Malda), West Bengal, Rangpo (Sikkim), Deogarh (Odisha), Bademarenga (Chhattisgarh), Gumla and Maheshpur Raj (Jharkhand), Agartala (Tripura), Dimapur (Nagaland), Shillong (Meghalaya), Imphal (Manipur) and Aizawl (Mizoram) and two (2) Sub-Research Extension Center (Sub-RECs) at Bhandra and Rajmahal (Jharkhand), besides, generating expertise in mulberry sericulture through its various Human Resource Development programmes / 15 months structured “Post Graduate Diploma in Sericulture (PGDS)” course / On-job training / capsule / need based sponsored courses and contributing for vertical and horizontal growth of sericulture industry especially in Eastern and North-Eastern India comprising of 13 states viz. West Bengal, Sikkim, Odisha, Chhattisgarh, Jharkhand, Bihar, Assam, Tripura, Nagaland, Meghalaya, Arunachal Pradesh, Manipur and Mizoram.

Mandate:

The core areas of work of CSR&TI, Berhampore (WB) are as follows:

- ❖ Constant up-gradation of productivity of silkworm races (Multivoltine, Multi x Bivoltine and Bivoltine x Bivoltine) and mulberry strains in its areas of operations for irrigated and rainfed mulberry.
- ❖ It shall be the testing centre for all mulberry silkworms related experiments or feeding technologies evolved in CSB Institutions or referred by other agencies to CSB in the states identified for it.
- ❖ Human resources development through training and academic duties.
- ❖ Coordination with DOSs for development of sericulture industry.

The institute conducts research on all fields of sericulture from soil to silk. Entrusted with the mandate to carry out research, it has made remarkable break through and outstanding contributions for the overall development of silk industry in the region. In the plant side, improved mulberry varieties, suitable to the agro climatic condition of different areas, have been developed along with its package of practices. On the silkworm side, region and season specific high yielding silkworm breeds have been evolved. The institute has developed integrated management of mulberry and silkworm diseases and pests, which are being popularized in the fields and proved to be effective to save the crop losses. With regard to post cocoon technologies improved cooking and the Institute has developed reeling techniques.

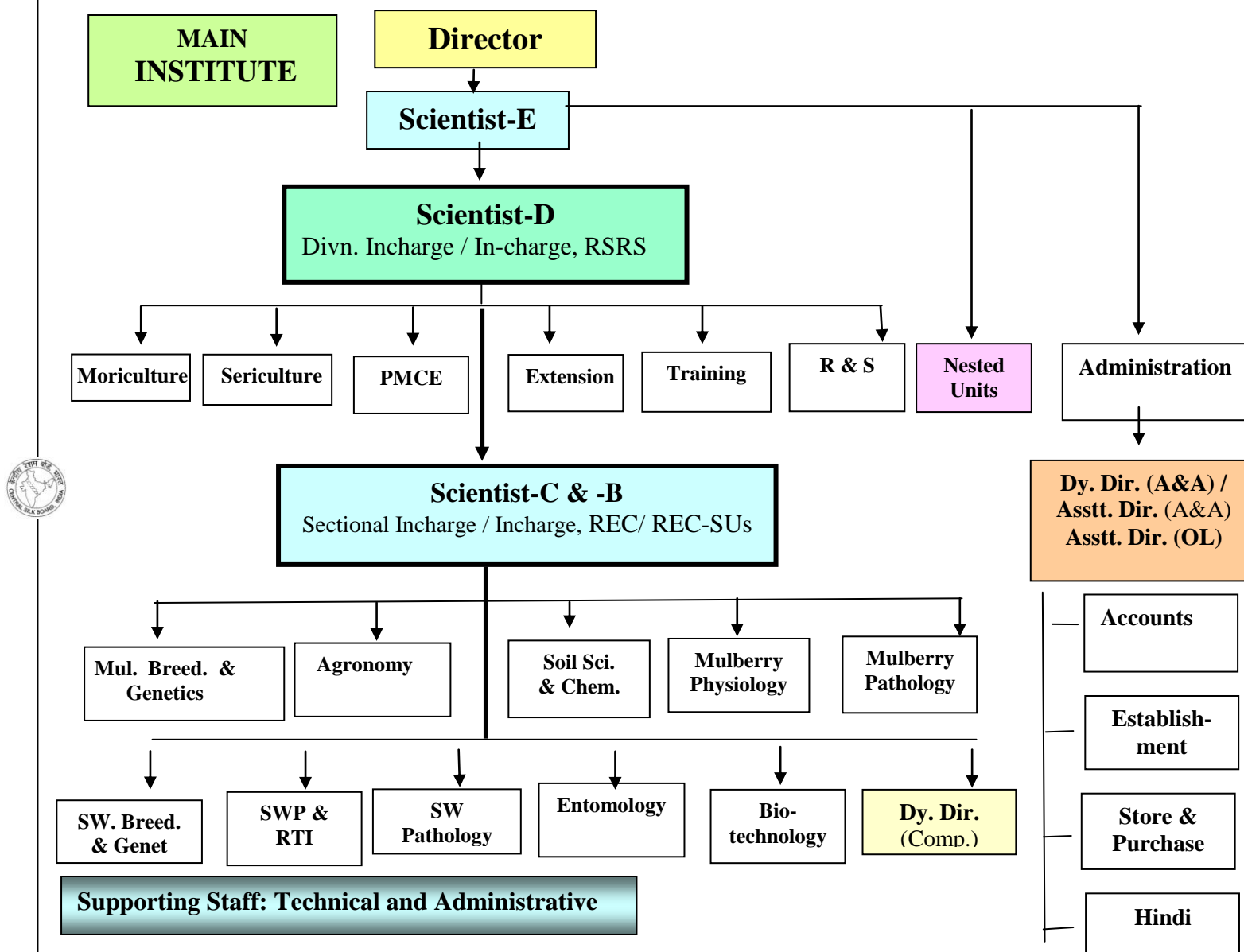


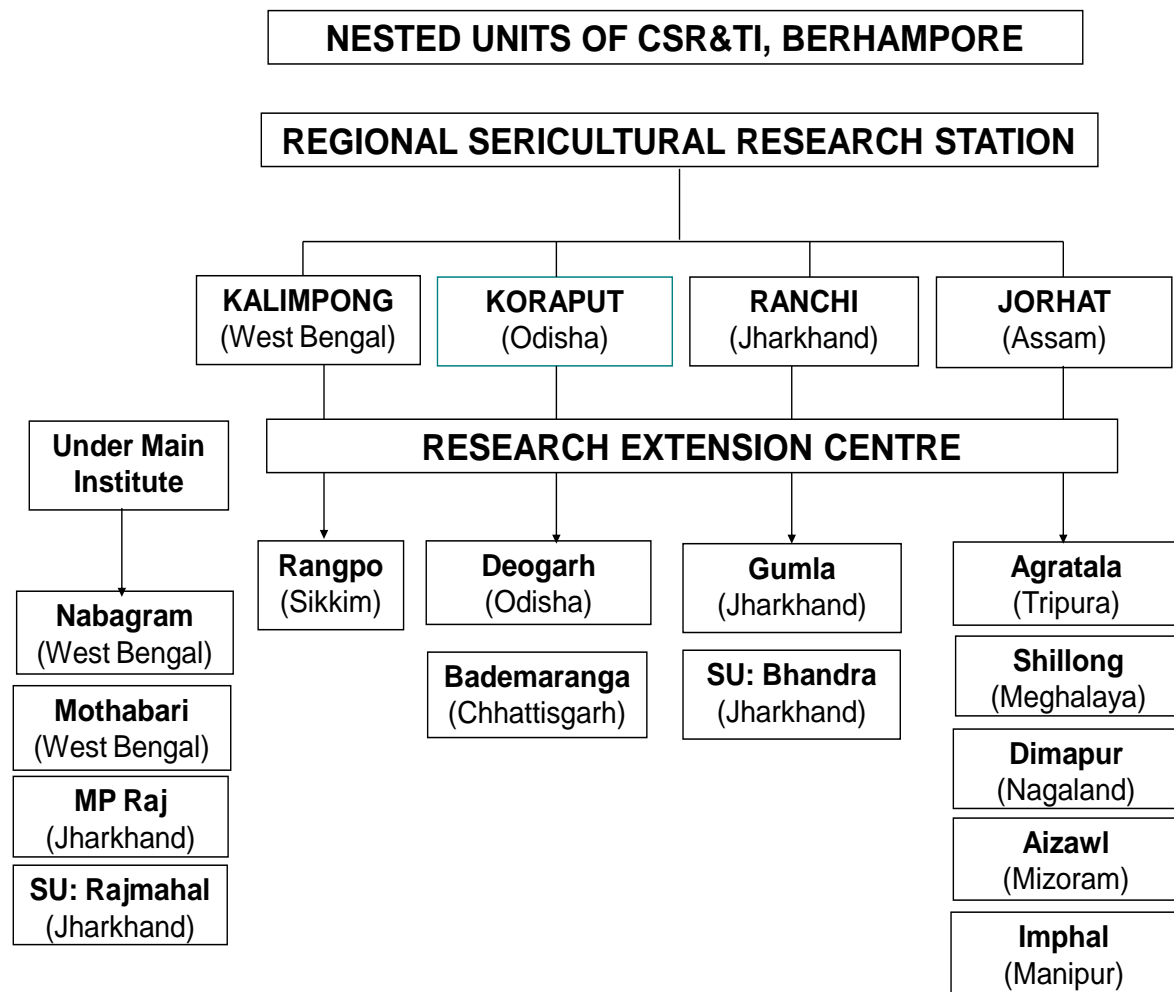
ACHIEVEMENTS ON RESULTS FRAME WORK DOCUMENTS (RFD)

Sl. No.	Objective	Action point / Success indicator	Target for 2012-13	Achievement	% Achievement
1	Undertaking Research Projects to enhance quality and productivity	No. of Research Projects/ Prog. to be undertaken.	39	47	120 %
		No. of Projects to be concluded.	11 (1 proj. + 9 Prog. + 1 Pilot Study)	15 (1 proj. + 13 Prog. + 1 Pilot Study)	136%
		No. of New Research Projects/ Prog. to be taken up.	2	8 (7 proj. + 1 Prog.)	400 %
2	Evaluation of improved varieties of mulberry and its dissemination to field.	Development of high yielding mulberry varieties	1	3	300%
		Absorption of the varieties in the field.	1	2	200%
3	Developing improved bivoltine / multivoltine breeds suitable to tropical regions and dissemination to field.	Development of improved bivoltine / multivoltine breeds.	1	2	200%
		Absorption of the breeds in the field.	2	3	150%
4	Integrated and Disease management and its dissemination to field.	Development of technologies / solutions.	1	3	300%
		Absorption of technologies / solutions.	1	2	200%
5	Food plant / silkworm race authorisation programme.	Area covered in farmers' field for trial of new mulberry varieties.	5	7.5	150%
		Dfls proposed for field trials	2160	2310	107%
6	To extend the coverage of proven technologies to larger areas.	Stakeholders sensitized through Krishi melas, awareness & training prog.	11000	19852	180%
7	Adoption of sericulture villages / clusters under IVLP (Farmers covered).	Coverage of cluster/ villages	285	297	104%
8		Coverage of beneficiaries.	1257	2455	195%
9	Replacement of existing plantation with improved varieties.	Area replaced from existing plantation with better yielding mulberry varieties.	45	60.08	133%
10	Attention to emerging field problems.	Successfully resolving the reported field problems.	5	36	720%
11	Identify the disease occurrence in advance & forewarn the beneficiaries with remedial measures.	Instances where such activities were undertaken.	14	69	492%
12	Implement ISO 9001 as per approved action plan.	Areas of operation covered	98	100	100%



ORGANIZATIONAL CHART OF CSR&TI, BERHAMPORE





3. LIST OF RESEARCH PROJECTS AND PROGRAMMES

Institute/ RSRS	Ongoing			Concluded			Total			Grand Total
	Proj.	PS	Prog.	Proj.	PS	Prog.	Proj.	PS	Prog.	
CSR&TI	17	1	10	1	1	10	18	2	20	40
RSRS	1	-	6	-	-	4	1	-	10	11
Total	18	1	16	1	1	14	19	2	30	51

Sl. No.	Project Code	Project Title
I. RAINFED SERICULTURE (1)		
1.	B-RNC(VP) 007	Validation trial of package of nutrient under rainfed condition. (RSRS, Ranchi) (Oct., 2011 to Oct., 2013).
II. PRODUCTIVITY IMPROVEMENT (24)		
2.	PIP 3469	Screening of early sprouters and late senescence mulberry variety with better leaf yield and quality under low temperature condition. (Nov., 2011 to Oct., 2014).
3.	AIB 3466	Development of region specific bivoltine breeds suitable for highly fluctuating and seasonally variable climatic conditions of Eastern and North-Eastern India. (Aug., 2011 to Dec., 2016).
4.	BPP (VP) 008	Field evaluation of plant growth regulator combination for improvement of quality leaf yield of mulberry especially under cold stress condition. (Dec., 2011 to Dec., 2013).
5.	BAI (P) 007	Establishment of molecular IDs for the mulberry silkworm breeds (<i>Bombyx mori</i>) evolved by CSR&TI, Berhampore. (July, 2011 to June, 2013).
6.	BAI (P) 008	Screening and identification of bivoltine breeds for Eastern and North-Eastern India. (Aug., 2011 to March, 2013).
7.	BAI (P) 009	Field level testing of new hybrids. (Jan., 2011 to Dec., 2012). [Collaboration with RSRSs & RECs] [CONCLUDED]
8.	BAI(P) 010	Popularization of authorized silkworm (<i>Bombyx mori</i> L.) hybrids. (Sept., 2010 to Aug., 2012). [CONCLUDED]
9.	MSRAP Phase-VIII	MSRAP Phase-VIII programme. (Jan., 2011 to Dec., 2012). [A Prog. of C.O. Bangalore]) [CONCLUDED]
10.	BAI(RP) 003	Maintenance of bivoltine and multivoltine germplasm and newly developed breeds and their lines. (April, 2012 to March, 2013). (Continuous) [CONCLUDED]
11.	BPP (PS) 001	Improvement of mulberry through <i>in vitro</i> mutagenesis and somaclonal variation. (July, 2011 to Dec., 2012). [CONCLUDED]



12. AIP 3472	Standardization and determination of temperature tolerance potentiality in different developmental stages of silkworm, <i>Bombyx mori</i> L. (Sept., 2011 to Aug., 2014).
13. BPP(VP) 003	Validation trial on the superiority of paired row plantation in chawki mulberry garden with regard to leaf yield and cocoon productivity. (Oct., 2010 to Sept., 2012). [CONCLUDED]
14. BMO(P) 003	Technology assessment and refinement through Institute Village Linkage. Prog.: Phase-III. (Apr., 2010 to Mar., 2013). [Collaboration with RSRs & RECs] [CONCLUDED]
15. Project (DBT funded)	Development of DNA marker based genetic linkage map of mulberry and QTL analysis for agronomically important <i>Planta</i> traits. (March, 2011 to Feb., 2014). [Collaborative with CCMB, Hyderabad]
16. Project (DST funded)	Improvement of mulberry seed cocoon production at farmers' level with special reference to bivoltine seed cocoon in West Bengal. (Nov., 2011 to Oct., 2012). [Collaborative with DST, West Bengal] [CONCLUDED]
17. AICEM Phase- III	All India Coordinated Experimental Trail for Mulberry (AICEM)-Phase III (April, 2011 to June, 2015). [A Prog. of C.O. Bangalore]
18. AIE 3454	Evaluation of elite bivoltine silkworm germplasm under different agro climatic conditions: All India Silkworm Germplasm Evaluation Programme Phase-II. [Collaborative with CSGRC Hosur] (Sept., 2011 to Aug., 2014).
19. MOE 3459	Yield gap in mulberry sericulture – A study in North-Eastern region of India. (Oct., 2011 to Sept., 2014).
20. AIB 3480	Development of silkworm <i>Bombyx mori</i> L. breeds from a gene pool with higher genetic plasticity. (Sept., 2012 to Aug., 2016).
21. AIB-3491	Post-Authorization trial of silkworm hybrids in Eastern and North-Eastern India (July, 2012 to Dec., 2014).
22. AIB-3496	Development of high temperature and high humidity tolerant bivoltine breeds of silkworm (<i>Bombyx mori</i> L.). (July, 2012 to June, 2015).
23. PIB-3481	Evaluation of mulberry varieties for low input soils. (Jan., 2013 to Dec., 2017).
24. PIB-3479	Development of high yielding mulberry varieties using physiological growth parameters as markers for selection. (Oct., 2012 to Sept., 2016).
25. B-KPG (P) 015	Improvement of rearing technology for autumn crop in sub-Himalayan region. (Aug., 2012 to Jan., 2014).



III. QUALITY IMPROVEMENT (9)

26. PPF-3487	Decision support system initiative through impact assessment of agro climate on foliage yield of mulberry (<i>Morus sp.</i>) for climate resilient sericulture in Eastern India. (Oct., 2012 to Sept., 2013).
27. PIB 3424	Development of low temperature stress tolerant mulberry genotypes for sub-tropical plains. (Jan., 2009 to Dec., 2015).
28. PPS 3452	Terrestrial carbon sequestration for sustained high productivity of quality mulberry. (July, 2011 to March, 2015).
29. BPP (P) 020	Evaluation of soil fertility for sustained production of quality mulberry leaf in Eastern India under long-term fertilization. (July, 2010 to June, 2015).
30. PPS 3435	Studies on micronutrients for sustained high productivity of quality mulberry in Eastern and North-Eastern India. (Jan., 2010 to June, 2013). [Collaboration with 4 RSRSs]
31. B-KPG (P) 016	Assessment of fertility status of soils of RSRS farm and progressive farmers' fields in selected seri. villages of Kalimpong to increase the yield and quality of mulberry (<i>Morus spp</i>) leaves. (Oct., 2011 to Dec., 2012). [CONCLUDED]
32. B-KPT (P) 017	Assessment of fertility status of mulberry growing soils in selected Seri-village of Koraput for appropriate fertilizer management. (Jan., 2012 to Dec., 2013).
33. B-RNC (P) 018	Assessment of fertility status of mulberry growing soils in selected Seri-village of Ranchi for appropriate fertilizer management. (Jan., 2012 to Dec., 2013).
34. B-JRH (P) 019	Assessment of fertility status of mulberry growing soils in selected Seri-village of Jorhat for appropriate fertilizer management. (Jan., 2012 to Dec., 2013).

IV. DISEASE AND PEST MANAGEMENT (13)

35. CSS 2107	Forewarning of mulberry diseases of Eastern and North Eastern India (April, 2012 to March, 2017).
36. ARE 3464	Biology and feeding efficacy studies of <i>Scymnus pallidicollis</i> (Mulsant) for the eco-friendly management of pink mealy bug, <i>Maconellicoccus hirsutus</i> . (Oct., 2011 to April, 2013).
37. BAR (VP) 005	Study on the efficacy of newly developed bed disinfectant (Sericillin) in hot spot areas for the control of muscardine disease of silkworm, <i>Bombyx mori</i> L. (Aug., 2010 to Jul., 2012). [CONCLUDED]
38. BPR(VP) 006	Studies on the field efficacy of selected dose of insecticide in whitefly management. (July, 2011 to June, 2013).
39. BAR(PS) 002	Formulation of broad spectrum room disinfectant for silkworm disease management. (Aug., 2011 to July, 2013)



40. Prog.	Survey and surveillance of disease and pest of mulberry and silkworm. (April, 2011 to March, 2013). (Routine activity) [RSRS, Koraput] [CONCLUDED]
41. BAR (P) 013	Studies on the identification of the casual agent symptomatic of Gattine like disease in silkworm <i>Bombyx mori</i> L. (Jan., 2012 to Dec., 2012). [CONCLUDED]
42. B-RNC(RP)-004	Survey and surveillance of disease and pest of mulberry and silkworm. (April, 2011 to March, 2013). (Routine activity) [CONCLUDED]
43. BAR(RP) 005	Survey and surveillance of silkworm diseases in the traditional sericultural districts of West Bengal. (Continuous) [CONCLUDED]
44. BPP(P) 021	Development of the weather based forecasting models for mulberry pests. (Jan., 2011 to Dec., 2015). [Collaboration with RSRSs & RECs]
45. DBT funded PIG 3441	Development, validation and utilization of SCAR marker(s) for powdery mildew (<i>Phyllactinia corylea</i>) resistance in mulberry. (Nov., 2009 to Oct., 2012). [Collaborative with CCMB, Hyderabad]
46. B-KPG(P) 006	Muga seed multiplication programme (Nov., 2009 to Oct., 2014). [Raising of Muga host plantation at RSRS-Annex, Kalimpong]. (As per the Central Office Letter no.:CSB-65/1/2004-05/TS-4/ Dated 16-10-09). (RSRS, Kalimpong).
47. B-JRH(P) 011	Studies on the biology and feeding efficiency of the coccinellid predator, <i>Scymnus</i> sp. for management of whitefly on mulberry). (RSRS, Jorhat). (April, 2011 to March, 2013). [CONCLUDED]
V. COST REDUCTION (4):	
48. BPP(P) 012	Studies on reduction in cost of production and improvement on crop productivity for sustainable sericulture under West Bengal conditions. (Sept., 2011 to Feb., 2013). [CONCLUDED]
49. BPP(RP) 001	Mother culture maintenance of <i>Azotobacter chroococcum</i> and Nitrofert mass production. [Micro project, (Continuous)]
50. BPP(RP) 002	Mother culture maintenance of <i>Glomus mosae</i> [(Arbuscular mycorrhizal fungus (AMF)] and Phosphofert mass production. [Micro project (Continuous)]
51. BAI (P) 014	Studies on the reelability of multivoltine hybrid cocoons during adverse climatic conditions in Eastern & North-Eastern region. (July, 2011 to March, 2014).



3.A. ONGOING RESEARCH PROJECTS & PROGRAMMES OF MAIN INSTITUTE

3.1. PRODUCTIVITY IMPROVEMENT

3.1.1. MULBERRY BREEDING AND GENETICS SECTION

3.1.1.1. PIB 3479: Development of high yielding mulberry varieties using physiological growth parameters as markers for selection. (Oct., 2012 to Sept., 2016)

Jalaja S. Kumar (PI) and P. K. Ghosh

Objective: To develop mulberry varieties with superior quality and with 10% higher leaf yield over existing ruling variety.

Mulberry germplasm accessions maintained at the germplasm bank of the Institute were screened and six female parents *M. indica* (HP), China White, Chinese F-1(10), MS-30, *M. multicaulis* and Kajli OPH were short listed. These female parents were crossed with the selected male parents Nagaland, MS-7, Bishnupur-9, KPG-1, Berhampore-39, English black, Almora local, Kosen, V-1, C-776, Chaitul and Acc. No. 1190. A total of 57 cross combinations were made and about 1.45 lakh seeds were collected.

3.1.1.2. PIB 3481: Evaluation of Mulberry varieties suitable for low input soils. (Jan., 2013 to Dec., 2017)

M. K. Ghosh (PI), P. K. Ghosh, S. K. Dutta, M.V. Santhakumar, M. K. Singh, S. N. Gogoi (RSRS-Jorhat), S. K. Misro (RSRS-Koraput), G. S. Singh (RSRS-Ranchi), DoT (Seri), Bhadrapur and DoT (Seri), Fulhara, West Bengal.

Objective: To evaluate newly evolved promising mulberry varieties suitable for low-input soils.

Seven mulberry genotypes selected from high yielders at PYT level were evaluated under final yield trial at six locations. At Institute level, test of the varieties are taken under two input conditions (rainfed and irrigated doses of chemical fertilizers) of tropical humid climate. Experiments at two nested RSRSs, will cover testing of varieties under low input in high rainfall humid climate (Jorhat) and low rainfall dry climate (Koraput). Experiment at sub-REC, Bhandra under RSRS, Ranchi, will cover study on the performance of the varieties under more severe conditions of low rainfall, drought prone areas of Jharkhand. Two no. of trial sites in collaboration with DOT (Seri) West Bengal in their Farms at Bhadrapur (Birbhum district) and Fulhara (Uttar Dinajpur district) will cover two more agro-climatic conditions of South Bengal (rainfed area) and North Bengal (high rainfall, acidic soil condition). The proposed Final Yield Trial will cover the most of the soil and agro-



climatic conditions of Eastern and North-Eastern India. For multiplication of the selected 7 newly evolved genotypes, cuttings were planted in the nursery beds. Regular irrigation and weeding are being provided.

3.1.2. MULBERRY PHYSIOLOGY SECTION

3.1.2.1. PIP 3469: Screening of early sprouters and late senescence mulberry accessions with better leaf yield and quality under low temperature condition. (Nov., 2011 to Oct., 2014)

A. K. Misra (PI) and P. K. Tewary.

Objective: Screening of mulberry accessions having early sprouters and late senescence characters with better leaf yield and quality under low temperature condition.

E01. Short listing of mulberry accessions from Germplasm Bank having the early sprouter and late senescence characters.

Sprouting of 76 germplasm (25 Exotic and 51 Indigenous) and 73 elite accessions were studied. The data revealed that initiation of sprouting in exotic and indigenous accessions completed within 14 to 37 days and 11 to 34 days, respectively. Among the exotic accessions, Bogura-4 and FERNANDS (Fernandodias) exhibited early and late sprouting respectively, where as, in indigenous accessions, Kolitha-3 sprouted early and MS-9 sprouted late. Out of 73 elite accessions, initiation of sprouting completed within 11 to 22 days. However, early sprouting was recorded in C-1726, S-1676, S-1622 and late sprouting in S-1703, C-1607. Frequency analysis of the bud sprouting of mulberry accessions has been done and grouped into following classes (Table 1).

Table 1. Sprouting behaviours of mulberry accessions.

Mulberry Accessions	No. of accession (Days to sprout)		
	Early	Moderate	Late
1. Exotic (25)	10 (14-21 days)	12 (22-29 days)	3 (30-37 days)
2. Indigenous (51)	18 (11-18 days)	25 (19-26 days)	8 (27-34 days)
3. Elite lines			
C-lines (38)	7 (11-14 days)	23(15-18days)	8(19-22 days)
S-lines (35)	10 (11-13 days)	15(14-16 days)	10(17-19 days)

Days to leaf senescence were counted from date of sprouting to yellowing of leaves. Senescence of leaves of exotic and indigenous accessions was ranged between 62 and 90 days & 56 and 93 days respectively while for elite lines, it was 59 to 96 days. Among exotic accessions, *M. cathyana* and *M. rotundiloba* were recorded as early and late senescent accessions respectively, whereas, Golaghat and Mysore local were early and late senescent among the indigenous accessions. Among 73 elite



accessions, C-1647, C-776, C-1627, S-1703 and S-1659 were recorded as early and C-1540, C-741, C-1607, S-1622, S-1662 and S-1676 were recorded as late senescent accessions.

3.1.2.2. BPP(VP)008: Field evaluation of plant growth regulator combination for improvement of quality leaf yield of mulberry especially under cold stress condition. (Dec., 2011 to Nov., 2013)

P. K. Tewary (PI), A. K. Misra and Inchages, DoT (Seri) Farms, Khosbag, Kumarpur, Kotasur, Sadullapur and Ranaghat.

Objective: To confirm the effect of Benzyladenine + KCl combination in respect to increase leaf yield of mulberry.

The evaluation trial was conducted at five DoT(Seri) West Bengal Farm at Khosbag and Kumarpur of Murshidabad, Kotasur of Birbhum, Sadullapur of Malda and Ranaghat of Nadia Districts with the existing plantation of S-1635 mulberry variety. Plants were pruned during September month for November crop followed by necessary cultural practices. After 20 days of pruning, 1st foliar spray of Benzyl adenine + KCl combination was given and subsequently 2nd spray was given after 20 days of 1st spray. Leaf yield data recorded during November crop, at all the five DoT(Seri) farms showed increase of leaf yield to the tune of 34.5% at Khosbag, 30.9% at Kumarpur, 34.4% at Kotasur, 36.4% at Sadullapur and 35.3% at Ranaghat DoT(Seri) farms, with an overall increase of 34%.

However, the pooled leaf yield data of two winter crops (November & February) at 5 DoT (Seri) farms exhibited an overall increase of 29% which was significantly higher in winter season irrespective of the locations.

3.1.3. SILKWORM BREEDING AND GENETICS SECTION

3.1.3.1. AIB 3466: Development of region specific bivoltine breeds suitable for fluctuating and seasonally variable climatic conditions of Eastern and North-Eastern India. (Aug., 2011 to Dec., 2016)

N. Suresh Kumar (PI), A. K. Saha, S. Chakraborty, S. Sreekumar and N. B. Kar

Objective: To develop the bivoltine breeds with genetic potential to tolerate the adverse climatic conditions of Eastern, North Eastern and Uttar Pradesh regions.

The bivoltine silkworm breeds collected from different breeding centres were screened in ambient condition and maintained under congenial environment. Based on overall performance especially the pupation rate, the breeds namely, GEN3, SK6, SK7, BHR2, BHR3, SK4C, D6PN, KSO1, Dun21, Dun22, KPGA, SK3C, MC4E, CSN, NB18, NB4D2, Chinese peanut and P5 were selected. By utilizing these



selected breeds, foundation crosses (Oval x Oval and dumbbell x dumbbell) were made for initiating the breeding process (Table 2).

Table 2. Performance of foundation crosses collected from different breeding centres.

Sl. No	Foundation cross	Sl. No.	Foundation cross	Sl. No.	Foundation cross
Oval x Oval					
1	KPGA x GEN3	6	KSO1 x SK3C	11	BHR2 x MC4E
2	KPGA x SK3C	7	KSO1 x MC4E	12	BHR2 x KSO1
3	KPGA x MC4E	8	KSO1 x KPGA	13	SK3C x GEN3
4	KPGA x BHR2	9	BHR2 x GEN3	14	SK3C x MC4E
5	KSO1 x GEN3	10	BHR2 x SK3C	15	SK3C x BHR2
Dumbbell x Dumbbell					
1	Dun21 x Dun22	21	D6PN x SK4C	41	SK4C x P5
2	Dun21 x D6PN	22	D6PN x NB4D2	42	SK4C x CSN
3	Dun21 x SK4C	23	D6PN x NB18	43	NB4D2 x NB18
4	Dun21 x NB4D2	24	D6PN x SK6	44	NB4D2 x SK6
5	Dun21 x NB18	25	D6PN x SK7	45	NB4D2 x SK7
6	Dun21 x SK6	26	D6PN x BHR3	46	NB4D2 x BHR3
7	Dun21 x SK7	27	SK6 x SK7	47	NB4D2 x C. peanut
8	Dun21 x BHR3	28	SK6 x BHR3	48	NB4D2 x P5
9	Dun21 x CSN	29	SK6 x CSN	49	NB4D2 x CSN
10	Dun21 x C. peanut	30	SK6 x C. peanut	50	NB18 x SK6
11	Dun21 x P5	31	SK6 x P5	51	NB18 x SK7
12	Dun22 x D6PN	32	SK7 x BHR3	52	NB18 x BHR3
13	Dun22 x SK4C	33	SK7 x CSN	53	NB18 x C. peanut
14	Dun22 x NB4D2	34	SK7 x C. peanut	54	NB18 x P5
15	Dun22 x NB18	35	SK7 x P5	55	NB18 x CSN
16	Dun22 x SK6	36	SK4C x NB18	56	CSN x C. peanut
17	Dun22 x SK7	37	SK4C x SK6	57	CSN x P5
18	Dun22 x BHR3	38	SK4C x SK7	58	C. peanut x P5
19	Dun22 x CSN	39	SK4C x BHR3		
20	Dun22 x C. peanut	40	SK4C x C. peanut		

3.1.3.2. AIB 3480: Development on silkworm *Bombyx mori* L. breeds from a gene pool with higher genetic plasticity. (Sept., 2012 to Aug., 2016)

G. K. Chattopadhyay (PI), A. K. Saha, N. Suresh Kumar and N. B. Kar

Objective: Development of bivoltine and multivoltine breeds with higher genetic plasticity.

E01: Development of multivoltine and bivoltine lines from polyhybrids gene pool i.e., convergent gene pool.



To screen a breeding line having genetic plasticity for shell weight and other line for survival at different seasons, six bivoltines, KPG-A, CSR-2, DUN-21, APS-45, RSJ-14 and B.Con.4 of higher cocoon shell weight and six multivoltines, N+p, Cambodge, Pure Mysore, MH-1, M.Con.4 and C. nichi of higher survival were collected from different regions. Step-wise rearing of the breeds was conducted during favourable (November to March) seasons. Distribution pattern of cocoon shell weight of the parental breeds are depicted in Fig. 1 & 2. The performance of bivoltine and multivoltine hybrids are presented in Table-3. The transgression study on shell weight over parents conducted on bivoltine and multivoltine hybrids separately are presented in Fig. 3 & 4. These hybrids will be assessed further during unfavourable (April to Sept.) seasons. Further, the step-wise four way convergent crosses were made separately among bivoltine and multivoltine to make separate lines to study the genetic plasticity in the gene pool for the target traits during unfavourable seasons.

Table 3. Rearing data of parental breeds and hybrids (November to March).

Breed / Hybrid	Fecundity	Hat. (No.)	Cocoon (No.)	Good Cocoon	Cocoon wt (g)	Surv. (%)	SCW (g)	SSW (g)	Shell (%)
A: Bivoltine									
B.Con.4	488	436	325	297	462	68.81	1.591	0.286	18.56
CSR-2	518	498	398	257	287	51.60	1.393	0.276	19.81
DUN-21	462	437	276	193	268	44.16	1.452	0.267	18.38
KPG-A	461	398	297	195	190	49.10	1.226	0.219	17.86
APS-45	513	497	381	305	326	52.51	1.176	0.225	19.39
RSJ-14	471	373	265	187	220	47.18	1.271	0.249	19.60
B: Multivoltine									
N+p	412	408	357	323	239	77.94	1.042	0.126	12.09
Cambodge	422	408	281	259	268	63.48	1.049	0.140	13.20
C. nichi	434	384	048	039	027	10.15	0.685	0.083	12.11
MH-1	460	411	271	260	384	63.26	1.325	0.190	14.19
PM	426	365	148	126	138	27.00	1.226	0.151	13.13
M.Con.4	543	527	352	335	482	65.99	1.442	0.232	16.08
C: Hybrid Performance (Bi x Bi)									
DUN-21x KPG-A	380	329	212	195	323	58.50	1.690	0.314	18.54
B.Con.4 x CSR-2	532	445	304	289	456	69.65	1.680	0.327	19.46
B.Con.4 x DUN-21	544	486	414	385	574	56.21	1.350	0.290	21.48
B.Con.4x KPG-A	405	365	273	263	386	57.05	1.497	0.270	18.03
D: Hybrid Performance (Multi x Multi)									
Nist+px Cambodge	416	359	313	299	359	83.49	1.150	0.151	13.13
M.Con.4 x PM	504	497	395	386	559	81.69	1.358	0.232	17.08
PM x Cambodge	445	408	312	304	395	74.51	1.276	0.168	13.16
PM x C. nichi	465	411	233	223	295	58.51	1.118	0.153	13.77
C. nichi x M.Con.4	531	516	397	497	490	75.75	1.440	0.229	15.95



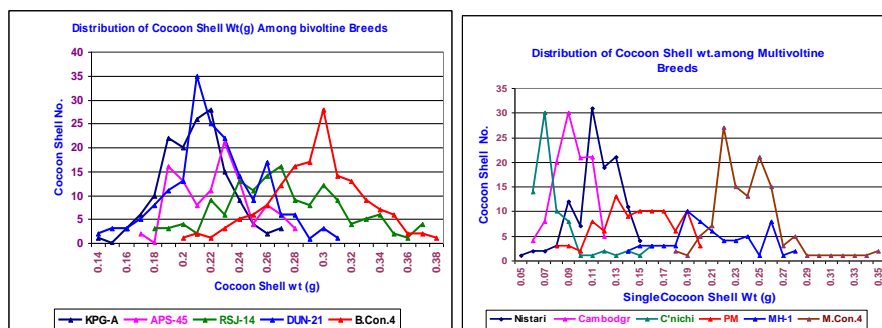


Fig 1 & 2. Cocoon shell weight Bivoltine & Multivoltine breeds

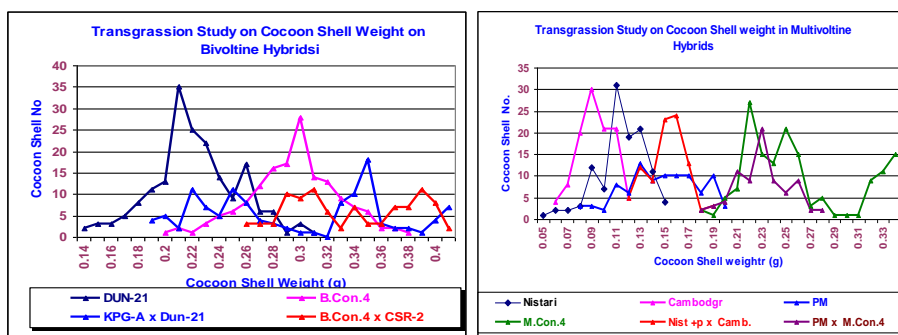


Fig 3 & 4. Transgression study: Bivoltine hybrids & Multivoltine hybrids

3.1.3.3. AIB 3496: Development of high temperature and high humidity tolerant bivoltine breeds of silkworm (*Bombyx mori* L.). (July, 2012 to June, 2015)

N. Suresh Kumar (PI), G. K. Chattopadhyay and A. K. Saha

Objective:

- Determination of LD50 in silkworm.
- To develop a method of induction for thermal stress in silkworm.
- Development of high temperature and high humidity tolerant breed.
- Biochemical characterization in relation to high temperature and high humidity stress.

Rearing of 10 bivoltine and 5 multivoltine breeds of the institute and 19 breeds (2 bivoltine and 17 multivoltine) of other Institutes designated as high-temperature tolerant were screened. The breeds were evaluated for high temperature and high humidity conditions of West Bengal showed highest survival in SK4C (90.4%) followed by SK7 (87.5%) and B. Con.4 (85.9%). Among the bivoltine breeds BBE-178, B.Con.4, D6PN, SK7, SK4C, Dun-21 and ATR29 showed survival of 80% while, in multivoltine breeds MH1, BMI-027, BMI-025, Nistari and M.Con.4 showed

survival of above 90%. The short-listed breeds were reared as per objective envisaged to identify the breeding resource material tolerant to high temperature and high humidity conditions.

3.1.3.4. BAI (P) 007: Establishment of molecular ID for the mulberry silkworm breeds (*Bombyx mori* L.) evolved by CSRTI, Berhampore. (July, 2011 to June, 2013)

S. Sreekumar (PI), G.K. Chattopadhyay and A.K. Saha

Objective: To establish molecular IDs of silkworm breeds developed at CSRTI, Berhampore.

Fifteen silkworm breeds (Indigenous 6 and Evolved 9) were selected for DNA finger-printing study to establish molecular IDs for protection of breeder's rights and issues related to IPR. Selected silkworm breeds were reared under standard conditions. Posterior silk glands and whole larval body, except alimentary canal, from both sexes were separated from the 3rd day of 5th instar larvae and kept at -86°C for DNA fingerprinting studies. Haemolymphs from different breeds were collected by puncturing the last prothoracic leg using a sterilized needle into labeled eppendorf tubes containing a pinch of PTU. The materials were centrifuged at 6000 rpm for 10 minutes in a cooling micro centrifuge at 4°C and the supernatant were collected in separate eppendorf tubes leaving the haemocytes and quickly transferred to -86°C for analysis of protein profiles pertaining to each breed.

3.1.3.5. BAI(P)008: Screening and identification of bivoltine breeds for Eastern and North Eastern India. (Aug., 2011 to Mar., 2014)

N. Suresh Kumar (PI), A. K. Saha, S. Sreekumar, G. K. Chattopadhyay, H. Lakshmi and N. B. Kar

Objective: Screening and identification of bivoltine breeds for Eastern and North Eastern India.

Bivoltine silkworm breeds collected from different breeding centres were screened in ambient condition, maintained and based on overall performance especially the pupation, 18 breeds namely GEN3, SK6, SK7, BHR2, BHR3, SK4C, D6PN, KSO1, Dun21, Dun22, KPGA, SK3C, MC4E, CSN, NB18, NB4D2, Chinese peanut and P5 were selected for breeding. By utilizing these selected breeds, foundation crosses (Oval x Oval and dumbbell x dumbbell) were made for making double hybrids (Table 3). Besides, by utilizing the above breeds, F1 hybrids were made for further evaluation (Table 4).



Table 4. List of F1 hybrids.

Sl. No.	F1 hybrids	Sl. No.	F1 hybrids	Sl. No.	F1 hybrids
1	KSO1 x Dun21	21	GEN3 x CSN	41	SK3C x NB4D2
2	KSO1 x Dun22	22	GEN3 x C. peanut	42	SK3C x NB18
3	KSO1 x D6PN	23	GEN3 x P5	43	SK3C x SK6
4	KSO1 x SK4C	24	KPGA x C. peanut	44	SK3C x SK7
5	KSO1 x NB4D2	25	KPGA x P5	45	SK3C x BHR3
6	KSO1 x NB18	26	KPGA x CSN	46	SK3C x CSN
7	KSO1 x SK6	27	KPGA x Dun21	47	SK3C x C. peanut
8	KSO1 x SK7	28	KPGA x Dun22	48	MC4(E) x Dun21
9	KSO1 x BHR3	29	KPGA x D6PN	49	MC4(E) x Dun22
10	KSO1 x CSN	30	KPGA x SK4C	50	MC4(E)x D6(P)N
11	KSO1 x C. peanut	31	KPGA x NB4D2	51	MC4(E) x SK4C
12	GEN3 x Dun21	32	KPGA x NB18	52	MC4(E)x NB4D2
13	GEN3 x Dun22	33	KPGA x SK6	53	MC4(E) x NB18
14	GEN3 x D6PN	34	KPGA x SK7	54	MC4(E) x SK6
15	GEN3 x SK4C	35	KPGA x BHR3	55	MC4(E) x SK7
16	GEN3 x NB4D2	36	SK3C x Dun21	56	MC4(E) x BHR3
17	GEN3 x NB18	37	SK3C x Dun22	57	MC4(E) x C. peanut
18	GEN3 x SK6	38	SK3C x D6PN	58	MC4(E) x P5
19	GEN3 x SK7	39	SK3C x P5		
20	GEN3 x BHR3	40	SK3C x SK4C		

3.1.3.6. BAI(RP)003: Maintenance of bivoltine and multivoltine germplasm and newly developed breeds and their lines. (April, 2012 to March, 2013) (Continuous)

Sunita Mukherjee (PI), N. Suresh Kumar, G. K. Chattopadhyay, B. B. Pattnaik, H. Lakshmi & A. K. Saha

Objective: To maintain the silkworm breeds confirming to their original breed characteristics.

A total of 24 multivoltine and 35 bivoltine silkworm germplasm are being maintained as stock lots. The performances of the breeds/ strains are presented in Table 5 and 6.



Table 5. Performance of multivoltine germplasm.

Sl. No.	Breed	Fecundity (No.)	Hatching (%)	ERR (kg)	Pupation (%)	SCW (g)	SSW (g)	Shell %
1	Nistari (Mark)+ <i>p</i>	412	94	5.75	80	1.042	0.126	12.09
2	Nistari(Plain) <i>p</i>	408	98	5.98	78	1.067	0.129	12.09
3	Chalsa	411	95	6.75	76	1.220	0.176	14.41
4	Sarupat	383	91	5.78	72	1.152	0.139	12.06
5	Pure Mysore	392	96	5.23	67	1.226	0.151	13.96
6	G	524	93	8.56	79	1.412	0.200	14.16
7	M2	429	93	7.65	76	1.328	0.187	14.38
8	O (Oval)	496	96	7.25	73	1.520	0.223	14.67
9	CB5	423	92	7.75	78	1.258	0.168	13.35
10	Cambodge	394	92	6.23	75	1.010	0.124	12.27
11	M12W	455	91	6.72	78	1.154	0.144	12.48
12	M6M81	511	94	8.78	72	1.322	0.195	14.75
13	M9A	455	94	7.47	77	1.451	0.204	14.06
14	M6DPC	459	95	8.52	78	1.148	0.144	12.54
15	M6DP(<i>Gc</i>)	423	95	5.86	72	1.272	0.165	12.97
16	M6DPC(E)	484	93	7.42	79	1.409	0.186	13.20
17	M15	451	94	7.40	72	1.120	0.148	13.21
18	M.Con.1	512	94	8.55	75	1.413	0.236	16.70
19	M.Con.4	545	95	12.16	77	1.490	0.231	15.50
20	OS616	525	92	9.12	75	1.247	0.171	13.71
21	M12(W)-Auto-sex + <i>p</i> female	423	92	4.42	45	1.198	0.152	12.69
22	M12W (Auto-sex) Dirty female	389	91	4.22	62	1.132	0.148	13.07
23	Nistari (Auto-sex) Yellow cocoon (Y) female	446	94	4.98	49	1.209	0.152	12.57
24	Nistari (Auto-sex) + <i>p</i> female	472	88	5.52	52	1.229	0.162	13.18

Table 6. Rearing performance of bivoltine silkworm germplasm.

Sl. No.	Breed	Fecundity (No.)	Hatching (%)	ERR (kg)	Pupation (%)	SCW (g)	SSW (g)	Shell %
1	KPG-A	498	97	12.72	82	1.434	0.259	18.09
2	KPG-B	489	95	11.89	72	1.608	0.300	18.67
3	KPG-11	478	96	13.13	81	1.384	0.257	18.60
4	P5	494	95	13.56	75	1.592	0.287	18.03
5	SH-6	464	96	15.42	83	1.496	0.263	17.58
6	SK3	495	95	15.00	78	1.561	0.279	17.87
7	SK4	482	96	11.46	75	1.497	0.264	17.63
8	D5	456	96	11.67	76	1.504	0.281	18.68
9	D6M	545	96	13.96	92	1.493	0.267	17.88
10	D6p	463	95	16.98	88	1.775	0.343	19.35
11	BHR1	461	96	11.79	78	1.577	0.298	18.89
12	BHR 2	512	96	11.87	70	1.609	0.296	18.43



13	BHR3	491	96	14.01	80	1.735	0.319	18.41
14	MJ 1	470	96	12.13	83	1.437	0.245	17.08
15	MJ 2	484	95	12.58	93	1.445	0.253	17.54
16	MC4(E)	458	96	11.95	78	1.504	0.262	17.42
17	MC4(O)	468	96	11.67	83	1.456	0.247	16.96
18	MC2	489	93	9.29	70	1.460	0.266	18.25
19	BG(W)	498	96	13.23	90	1.468	0.276	18.80
20	YB	529	96	12.10	77	1.429	0.247	17.28
21	NB18	500	95	12.44	78	1.656	0.305	18.42
22	Chinese(PN)	497	95	13.37	85	1.560	0.294	18.88
23	JPN	502	93	13.24	93	1.368	0.275	20.10
24	NB4D2	492	95	10.14	61	1.613	0.316	19.62
25	CSN	478	95	11.74	82	1.378	0.247	17.92
26	SK3C	469	96	15.95	85	1.401	0.256	18.27
27	SK4C	498	96	12.55	80	1.656	0.299	18.05
28	SK3N	567	96	12.93	84	1.436	0.262	18.28
29	SK4N	469	96	12.02	92	1.437	0.271	18.86
30	D6(P)N	560	97	12.57	87	1.491	0.277	18.58
31	D6(P)NP	533	96	11.85	79	1.484	0.277	18.66
32	SK6	551	96	14.40	87	1.661	0.325	19.59
33	SK7	547	96	15.56	91	1.706	0.295	17.32
34	B.Con.1	515	97	14.04	91	1.569	0.286	18.23
35	B.Con.4	485	95	12.09	95	1.591	0.286	18.56
35	CSR2	498	95	9.54	60	1.733	0.354	20.45

3.1.4. SILKWORM PHYSIOLOGY AND RTI SECTION

3.1.4.1. AIP 3472: Standardization and determination of temperature tolerance potentiality in different developmental stages of silkworm, *Bombyx mori* L. (Sept., 2011 to Aug., 2014)

A. K. Saha (PI), T. Datta (Biswas) and G. K. Chattopadhyay

Objectives: Determination of stage specific effect of different temperature (30-35°C) and humidity (>90%) on silkworm rearing. Determination of temperature and humidity tolerance potentiality based on 50% lethality and period of exposure for a specific instar.

A. Day and instar specific effect of thermal stress (temperature $32 \pm 1^\circ\text{C}$) + >90% relative humidity (RH) exposed during photophase and unexposed during scotophase.

Each day of 1st, 2nd, 3rd, 4th and 5th instars larvae of NB4D2, Nistari and M.Con.4 were exposed under targeted temperature and RH. Results revealed lethality (L) in all the instars except 2nd and 3rd day of 3rd instars and whole 5th instar of NB4D2. Although Nistari and M.Con.4 did not show lethal effect, cocoon yield was affected due to larval mortality compared to their respective controls (Table 7).



Table 7. Day & instar specific effect of thermal stress ($32\pm 1^\circ\text{C}$) + >90% RH exposed during photophase and unexposed during scotophase on rearing performance of silkworm.

Stage / Day	NB4D2		M. Con.4		Nistari	
	Survival (%)	Yield /100 dfls (kg)	Survival (%)	Yield /100 dfls (kg)	Survival (%)	Yield /100 dfls (kg)
1st instar						
1 st day	14 L	8.2	57	20.3	69	20.5
2 nd day	47 L	21.7	65	23.6	80	24.5
3 rd day	48 L	21.6	57	20.7	81	24.9
2nd instar						
1 st day	45 L	22.3	60	20.1	79	22.9
2 nd day	49 L	25.4	67	25.2	80	23.5
3rd instar						
1 st day	41 L	19.3	63	20.9	67	19.6
2 nd day	60	34.6	60	20.1	80	24.4
3 rd day	64	38.3	61	20.4	80	24.3
4th instar						
1 st day	45 L	21.5	74	23.5	58	18.2
2 nd day	41 L	23.1	62	20.5	60	19.8
3 rd day	43 L	21.2	68	25.2	68	21.0
4 th day	40 L	22.8	62	24.5	68	20.5
5th instar						
1 st day	76	32.8	80	28.5	74	23.8
2 nd day	74	33.2	82	25.3	76	23.7
3 rd day	76	33.8	80	27.2	76	23.9
4 th day	76	34.1	80	25.5	76	23.9
5 th day	74	32.3	82	28.5	76	22.2
Control	76	48.6	81	45.2	81	25.6

B. Instar specific effect of thermal stress ($32\pm 1^\circ\text{C}$) + >90% RH.

Excluding moulting period:

Lethality was recorded on 1st and 5th instars in Nistari and in all instars of Sarupat and SH6 except 4th instar of SH6. Although lethality was not recorded in those instars but cocoon yield was affected due to mortality as compared to their respective controls. Among the multivoltine and bivoltine breeds, Nistari performed better (Table 8).



Table 8. Instar specific effect of thermal stress ($32 \pm 1^\circ\text{C}$) + >90% RH (excluding moulting period) exposed during photophase and unexposed during scotophase on rearing performance of silkworm.

Stage / Day	Nistari		Sarupat		SH6	
	Survival (%)	Yield / 100 dfls (kg)	Survival (%)	Yield / 100 dfls (kg)	Survival (%)	Yield / 100 dfls (kg)
1 st Instar	41.9 L	14.0	27.3 L	8.4	26.1 L	8.4
2 nd Instar	69.7	22.8	30.8 L	11.2	47.5 L	14.3
3 rd Instar	67.5	21.4	29.1 L	10.0	41.7 L	13.0
Control	78.9	25.0	79.1	28.8	76.9	21.2
4 th Instar	53.7	16.8	33.0 L	11.6	51.0	21.6
5 th Instar	46.0 L	15.2	21.0 L	7.6	30.0 L	12.4
Control	83	25.3	81.7	30.0	79.7	36.0

Including moulting period:

Only 1st & 2nd instars larvae of the breeds Sarupat and Nistari and also 3rd instar of Nistari showed lethality. In SH6, lethality was recorded in all the instars and mortality was higher as compared to control. However, Sarupat performed better (Table 9).

Table 9. Instar specific effect of thermal stress ($32 \pm 1^\circ\text{C}$) + >90 % RH (including moulting period) exposed during photophase & unexposed during scotophase on rearing performance of silkworm.

Stage / Day	Nistari		Sarupat		SH6	
	Survival (%)	Yield / 100 dfls (kg)	Survival (%)	Yield / 100 dfls (kg)	Survival (%)	Yield / 100 dfls (kg)
1 st Stage	16.7 L	5.2	15.7 L	6.0	17.9 L	8.4
2 nd Stage	29.5 L	8.8	13.7 L	5.6	15.8 L	7.6
3 rd Stage	46.5 L	13.8	63.7	24.8	13.7 L	6.4
Control	78.8	22.6	77.1	27.6	76.9	40
4 th Stage	76.0	21.7	62.3	24.4	25.7 L	11.2
5 th Stage	65.0	18.2	65.0	21.2	24.0 L	10.8
Control	82.0	23.2	79.7	29.6	78.3	39.2

B. Instar specific effect of thermal stress ($35 \pm 1^\circ\text{C}$) + >90% RH.

Excluding moulting period:

Experiment conducted with three bivoltine breeds NB4D2, SH6 and B.Con.4 exposing them in targeted temperature and RH showed lethality in all the instars. However, B. Con.4 showed better as compared to other bivoltine breeds (Table 10). Nistari showed higher tolerance than the Sarupat and M.Con.4.



Table 10. Instar specific effect of thermal stress ($35\pm 1^\circ\text{C}$) + >90% RH (excluding moulting period) exposed during photophase and unexposed during scotophase on rearing performance of silkworm.

Stage	NB4D2		B.Con.4		SH6	
	Survival %	Yield / 100 dfls (kg)	Survival %	Yield / 100 dfls (kg)	Survival %	Yield / 100 dfls (kg)
1 st Stage	7.7 L	5.1	23.2 L	12.6	18.9 L	8.0
2 nd Stage	12.9 L	6.7	25.5 L	14.7	17.3 L	7.9
3 rd Stage	7.8 L	3.9	25.6 L	14.4	19.1 L	8.8
Control	68.1	34.1	78.1	40.2	71.6	32.8
4 th Stage	15.0 L	7.6	21.5 L	13.0	15.0 L	7.2
5 th Stage	8.0 L	3.5	15.0 L	8.4	8.0 L	3.9
Control	71.7	41.6	81.7	49.4	81.7	38.5

3.2. QUALITY IMPROVEMENT

3.2.1. MULBERRY BREEDING AND GENETICS SECTION

3.2.1.1. PIB 3424: Development of low temperature stress tolerant mulberry genotypes for sub-tropical plains. (Jan., 2009 to Dec., 2015)

M. K. Ghosh (PI) and P. K. Ghosh

Objective: Development of low temperature stress tolerant mulberry genotype capable of providing higher leaf yield during Agrahayani (Nov.) and Falguni (Feb.) silkworm rearing seasons than the ruling variety, S-1635.

S01: Hybridization, selection and preliminary screening of genotypes.

E02: Primary screening of genotypes through Progeny Row Trial (PRT).

A total of 31 new mulberry progenies were selected at Progeny Row Trial level based on days to sprout and leaf yield during winter season. After pruning on 30th November, winter leaf yield (Nov. and Feb.), annual leaf yield (g/plant), EC (dS/m), NRA ($\mu\text{mol NO}_2^- \text{g}^{-1} \text{fr. wt.}$) and sprouting data were recorded alongwith check variety (S-1635) (Table 11).

Table 11. Performance of the selected progenies.

Parameters	Mean value	Max.	Min.	SD	CV%
Sprouting duration (days after pruning)	9.3	10.5	8.0	0.80	8.57
Check variety (S-1635)	12.5				
Leaf yield during November (g/plant)	418.9	574.0	310.0	74.35	17.75
Check variety (S-1635)	220.0				



Leaf yield during February (g/plant)	422.3	560.0	330.0	61.07	14.46
Check variety (S-1635)	195.0				
Annual (5crops) leaf yield (g/plant)	2815.4	3866.3	2037.6	408.66	14.52
Check variety (S-1635)	1645.8				
EC (dS/m)	3.1	3.6	2.7	0.28	8.93
Check variety (S-1635)	2.3				
NRA (μ mol NO ₂ ⁻ g ⁻¹ fr. wt.)	10.3	12.7	8.7	1.01	9.83
Check variety (S-1635)	8.8				

3.2.1.2.PPF3487: Decision support system initiative through impact assessment of agroclimate on foliage yield of mulberry (*Morus* sp.) for climate resilient sericulture in Eastern India. (Oct.,2012 to Sept., 2013)

Monica Chaudhuri (PI) and M. K. Ghosh

Objective: To develop mulberry yield-weather model through space construction of a synthetic model using geo-referenced historical data mining and retrieving weather variables and leaf yield data from archive of remotely sensed satellite data and the Institute records respectively.

Mining and analyzing of retrospectively spatio-temporal historical data of 8 weather variables i.e. solar radiation, max. & min. temperature, wind speed, relative humidity, rainfall and drought and crop wise foliage yield of S-1635 for 10 years (2002-03 to 2011-12) for construction of yield weather equation.

3.2.2. SOIL SCIENCE & CHEMISTRY SECTION

3.2.2.1.PPS3452: Terrestrial carbon sequestration for sustained high productivity of quality mulberry. (July, 2011 to June, 2015)

S. K. Majumder (PI upto 19.05.2012) and R. Kar (PI from 20.05.2012)

Objective: To enumerate the enhanced organic carbon stock of the soil due to the induction of altered farming practices in mulberry dim fit to carbon sequestration with comparison to existing one.

Six combinations of farming practices along with a fallow replicated thrice in randomized block designed with S-1635 at 60 cm x 60 cm spacing were cultivated under different farming practices. Data pertaining to five crop-harvests of the year revealed significant variations among the farming practices and seasons with respect to productivity and carbon assimilation by mulberry plants (Table 12 and 13).



Table 12. Season wise mulberry productivity under different farming practices.

Farming practices	Leaf yield (mt ha ⁻¹)					Shoot yield (mt ha ⁻¹)				
	May	July	Sept.	Nov.	Feb.	May	July	Sept.	Nov.	Feb.
Intensive Tillage (IT)	6.12	9.19	8.41	6.94	5.83	3.38	5.86	7.09	3.01	3.99
IT + Grass	4.36	7.80	8.66	7.02	6.86	2.03	4.33	7.46	2.96	4.98
IT+Grass+cover crop	4.59	7.96	7.15	6.39	5.07	2.29	4.59	5.75	2.56	3.36
Moderate Tillage (MT)	5.48	8.97	8.08	7.40	5.81	2.97	5.01	6.93	3.05	4.04
MT+ Grass	5.69	8.91	7.97	6.95	6.68	2.58	5.59	6.84	3.16	4.91
MT+Grass+Cover crop	3.68	7.14	7.32	6.45	5.39	1.66	3.82	6.08	2.62	3.48
CD (Farming practice)	0.724					0.772				
CD (Season)	0.661					0.704				

Table 13. Season wise carbon assimilation by mulberry under different farming practices.

Farming practices	Carbon assimilation by leaf (mt ha ⁻¹)					Carbon assimilation by shoot (mt ha ⁻¹)				
	May	July	Sept.	Nov.	Feb.	May	July	Sept.	Nov.	Feb.
Intensive Tillage (IT)	0.58	0.87	1.06	0.75	0.55	0.41	0.70	1.04	0.40	0.29
IT + Grass	0.44	0.75	1.07	0.76	0.65	0.29	0.52	1.09	0.37	0.38
IT+Grass+cover crop	0.48	0.79	0.88	0.68	0.48	0.31	0.57	0.83	0.33	0.26
Moderate Tillage (MT)	0.56	0.85	1.04	0.81	0.55	0.37	0.61	1.02	0.39	0.30
MT + Grass	0.58	0.88	0.98	0.74	0.62	0.32	0.71	1.01	0.40	0.42
MT+Grass+cover crop	0.41	0.70	0.93	0.73	0.51	0.25	0.47	0.88	0.34	0.26
CD (Farming practice)	0.072					0.090				
CD (Season)	0.066					0.082				

3.2.2.2. BPP (P) 020: Evaluation of soil fertility for sustained production of quality mulberry leaf in Eastern India under long-term fertilization. (July, 2010 to June, 2015)

R. Kar (PI) and S. K. Majumder (upto 19.05.2012)

Objectives: To study the sustenance of mulberry productivity under long-term fertilization. Evaluation of soil fertility of mulberry gardens by the rational use of fertilizers and manures on long-term basis.

The study has completed seven years of experimentation comprising three combinations of nutrient-inputs replicated thrice in a RBD. Mulberry variety S-1635 with 60 cm x 60 cm spacing is being cultivated under different nutrient-inputs. Data pertaining to five crop-harvests of the year revealed significant variations for nutrient-inputs and seasons with respect to productivity and NPK uptake by mulberry (Table 14 &15). Besides, analysis of soil samples collected after sixth year of experimentation revealed that the performance of fertilizers application in conjunction with manure was better than only fertilizers as well as control in terms of soil fertility.



Table 14. Season wise leaf yield and N uptake by mulberry under different nutrient-inputs.

Treatment (kg/ha/year)	Leaf yield (mt ha ⁻¹)					N uptake (kg ha ⁻¹) by mulberry				
	May	July	Sept.	Nov.	Feb.	May	July	Sept.	Nov.	Feb.
No Nutrient	1.36	1.31	1.12	0.44	2.27	11.12	15.10	15.40	4.71	21.51
N ₃₃₆ P ₁₈₀ K ₁₁₂	4.16	6.11	6.51	3.83	4.78	36.77	54.99	87.18	39.87	49.76
N ₃₃₆ P ₁₈₀ K ₁₁₂ + FYM _{20mt}	6.86	10.01	9.20	7.07	5.73	63.09	102.57	127.60	75.03	48.60
CD (Nutrient)	0.427					5.36				
CD (Season)	0.552					6.92				
CD (Nutrient x Season)	0.956					11.99				

Table 15. Season wise P and K uptake by mulberry under different nutrient inputs.

Treatment (kg/ha/year)	P uptake (kg ha ⁻¹) by mulberry					K uptake (kg ha ⁻¹) by mulberry				
	May	July	Sept.	Nov.	Feb.	May	July	Sept.	Nov.	Feb.
No Nutrient	2.03	2.58	2.46	0.71	3.84	7.47	12.87	6.30	3.06	15.75
N ₃₃₆ P ₁₈₀ K ₁₁₂	5.62	8.77	10.21	5.36	6.72	23.37	49.83	48.36	25.07	27.86
N ₃₃₆ P ₁₈₀ K ₁₁₂ + FYM _{20mt}	8.63	13.83	16.37	11.32	9.00	37.90	82.65	73.23	48.68	39.48
CD (Nutrient)	0.81					3.99				
CD (Season)	1.04					5.15				
CD (Nutrient x Season)	1.81					8.92				

3.2. DISEASE & PEST MANAGEMENT

3.3.1. MULBERRY PATHOLOGY SECTION

3.3.1.1. CSS-2107: Forewarning of mulberry diseases of Eastern and North Eastern India. (A Multilocal Project) (April, 2012 to March, 2017)

S. K. Dutta (PI), N. K. Das, M. D. Maji, S. P. Chakrabarti, A. K. Dutta, D. Pandit, S. T. Lepcha, A. H. Naqvi, S. K. Misroo, M. Shankar, A. Borah, G. B. Singh, B. N. Choudhuri and L. S. Singh.

Objectives: Collection of disease incidence (weekly interval) and meteorological data (day wise). Publicity and recommendation of package of forewarning system in different locations. Development of long term and broad spectrum data base for disease and meteorology of Eastern and North Eastern India at the end of XII plan period. Due to climatic change existing disease forecasting models to be fine tuned at the end of XII plan and more



models to be developed when severity of disease is $> \text{ETL}$. Due to climatic change the existing disease calendar developed in the XI plan period to be fine tuned at the end of XII plan.

Fourteen centres CSR&TI, Berhampore (Murshidabad), REC, Bagmara (Malda), REC, Kamnagar (Murshidabad, including Birbhum), RSRS, Kalimpong (West Bengal), REC, Rangpo (Sikkim), RSRS, Ranchi (Jharkhand), REC, Maheshpur Raj (Jharkhand), RSRS, Koraput (Odisha), REC, Bademaranga (Chhattisgarh), RSRS, Jorhat (Assam), REC, Dimapur (Nagaland), REC, Aizawl (Mizoram), REC, Agartala (Tripura) and REC, Imphal (Manipur). Data on disease incidence at farmers' fields at weekly intervals and day-wise meteorological data were recorded. Disease severity was correlated with meteorological factors such as, mean max. & min. temperature $^{\circ}\text{C}$ and relative humidity (%), number of rainy days and rainfall. In Eastern and North Eastern India different disease severity in different months were recorded.

Forewarning of mulberry diseases in Eastern and North Eastern India.

1. **Murshidabad:** Bacterial leaf spot (BLS) was observed during May to August with minimum incidence during May (1 PDI) and maximum during August (8 PDI). Sporadic incidence of *Myrothecium* leaf spot (MLS) was recorded during March to August and in October with minimum incidence during April (0.4 PDI) and maximum during March (2.2 PDI). *Pseudocercospora* leaf spot (PLS) was observed during February to August and in November with the severity range of 0.3 PDI to 13.9 PDI ($> \text{ETL}$). Powdery mildew (MLD) was observed during November with maximum severity of 3.3 PDI.
2. **Birbhum:** Sporadic incidence of BLS was recorded during April with minimum severity of 0.8 PDI. Sporadic incidence of MLS was recorded during April to September and PDI was ranged from 0.3 to 8.2 ($> \text{ETL}$). PLS was observed during April and June and PDI is ranged from 3.4 to 5.3.
3. **Malda:** MLS observed during February to November was 1.7 to 3.9 PDI ($< \text{ETL}$). PLS was recorded during April to July and in October with severity of $< \text{ETL}$. Low incidence of PLS was recorded during October (0.3 PDI).
4. **RSRS, Kalimpong:** Incidence of brown leaf rust, yellow leaf rust and Powdery mildew was recorded. Occurrence of Powdery mildew was 3.4 to 35.4 PDI during August to November, brown leaf rust during August to Nov. with maximum severity during Nov. (49 PDI). Least incidence of yellow leaf rust was 2.3 PDI during November.
5. **REC, Rangpo:** Incidence of Powdery mildew was recorded during July with maximum severity of 18.9 PDI and sporadic incidence of PLS of 3.5 PDI in the same month. Incidence of leaf rust was 5.7 PDI.
6. **RSRS, Koraput:** Rust incidence was recorded during March to June and Sept. to Dec. and the severity ranged between 0.9 PDI (March) and 4.1 PDI (May).



- Sporadic incidence of Powdery mildew was recorded during Nov. and Dec. and severity was <ETL. During June to Dec., MLS was recorded with 1.9 to 3.6 PDI.
7. **RSRS, Ranchi:** Low incidence of Powdery mildew was recorded during August to Dec. (0.2 to 0.8 PDI). However, incidence of MLS and leaf rust was not observed.
 8. **REC, Maheshpur Raj:** Sporadic incidence of bacterial leaf spot disease was observed during July to Sept. and severity was 3 to 5.6 PDI. However, severity was >ETL during July. Sporadic incidence of PLS with 2.9 to 3.4 PDI was observed during August to September.
 9. **REC, Bademaranga:** Leaf rust was recorded during October to November with the severity of 1.3 PDI <ETL.
 10. **RSRS, Jorhat:** Disease severity was recorded in both farm and farmers field. Incidence of rust disease was recorded during June (0.4 PDI), August (0.1 PDI) and Nov. (0.8 PDI). Sporadic incidence of Powdery mildew was recorded during Nov. (0.8 PDI). Incidence of MLS was recorded during Oct. to Nov. (0.2 to 0.5 PDI).
 11. **REC, Dimapur:** Sporadic incidence of MLS was recorded during August to September (3.5 to 7.2 PDI) and the leaf rust (3.8 to 7.3 PDI).
 12. **REC, Imphal:** Incidence of Powdery mildew was 2.2 PDI and leaf rust was 2 PDI in the month of July. During Sept., PDI of Powdery mildew was 0.1 and in Nov. sporadic incidence of both Powdery mildew and Leaf rust was recorded as 0.13 PDI and 0.25 PDI respectively.
 13. **REC, Aizawl:** Sporadic incidence of Powdery mildew and leaf rust was recorded during Nov. and December. Incidence of Powdery mildew ranged between 3.01 and 3.34 PDI and for the leaf rust the PDI was 1.70 to 1.83.
 14. **REC, Agartala:** Incidence of Powdery mildew was recorded during Nov. and Dec. with the severity of 19.5 to 38.9 PDI (> ETL).

3.3.2. ENTOMOLOGY SECTION

3.3.2.1.ARE 3464: Biology and feeding efficacy studies of *Scymnus pallidicollis* (Mulsant) for the eco-friendly management of pink mealy bug, *Maconellicoccus hirsutus* (Green). (Oct., 2011 to Sept., 2013)

M. Patnaik (PI) and M. V. Santha Kumar

Objectives: To study the life cycle, longevity and fecundity of the native predator on pink mealy bug, *Maconellicoccus hirsutus* (Green). To find out the feeding consumption of the predator on the life stages of mealy bug.



E01: Studies on the biology of *Scymnus pallidicollis* (Mulsant).

Cultures of mealy bug and its predator were maintained and multiplied. Studies on the life cycle of the predator reveal that the life cycle of the predator was completed in 23 days. The eggs of predators were elliptical and light yellow in colour. Incubation period was 4-5 days. 1st and 2nd instars ranged for 2-3 days, 3rd and 4th instars for 3-4 days, pre-pupal and pupal periods were 1 day and 6 days respectively.

E02: Studies on the feeding efficacy of predatory grubs on eggs and nymphs of *M. hirsutus*.

Experiments were conducted to determine the feeding efficacy of predatory grubs and adult predator on different development stages of pink mealy bug under laboratory condition at 25 to 28°C temperature and 65 to 70% relative humidity. After hatching each predatory grub was kept in a cavity block and provided with a known number of preys. Data recorded on number of preys consumed at every 24 hours revealed that a grub consumed 566 eggs or 21 nymphs and a male predator consumed 1,612 eggs or 211 nymphs or 32 adults of mealy bug during its life period. The studies of mating behaviour revealed that the pre-mating, mating and post-mating periods were 5, 32 and 21 days respectively.

3.3.2.2. BPR(VP)006: Studies on the field efficacy of selected dose of insecticide in whitefly management. (July, 2011 to June, 2013)

M.V. Santha Kumar (PI), M. Patnaik and A. K. Saha

Objective: To confirm the efficacy of selected dose of pesticide (0.015% thiamethoxam) in regulating the population of whitefly through validation of the findings emanated from the concluded project PRE 3394 conducted at DoT(Seri.) farms and farmers' fields.

The study was conducted at DoT (Seri.) farm, Ramkrishnapur, Khikirbona, Maushimpur, Khanpara, Pyesbari and Bakharpor villages of Malda district, DoT (Seri.) farm, STC, Berhampore, Kharjoura, Ballaspore, Sayedpur, Karjora villages of Murshidabad District and DoT (Seri.) farm, Karimpur, Kuchaidanga, Barbakpur, Harekrishnapur, Tokipur, Pipulkhola, Rahmatpur villages of Nadia District.

In **Malda** district, during Bhaduri (July-Aug.) and Agrahayani (Sept.-Nov.) crops, at 5 villages (43 farmers), foliar application of thiamethoxam (0.015%) suppressed the whitefly population to an extent of 80% and 82% and thereby with a leaf yield gain of 27% and 28% respectively. In **Nadia** district, during Aswina (Aug.-Sept.) and Agrahayani (Oct.-Nov.) crops, at DoT (Seri.) farm, Ranaghat and by 20 farmers' at 7 villages showed that application of thiamethoxam (0.015%) suppressed the whitefly population by 74% and 85% with a leaf yield gain of 18% and 21% respectively. In **Murshidabad** district, during Aswina (Aug. to Sept.) and Agrahayani (Oct. to Nov.) crops, at DoT (Seri.) farm, Berhampore by 42 farmers at 4 villages



revealed that application of thiamethoxam (0.015%) suppressed the whitefly population upto 91% and the leaf yield gain was 19% more.

3.3.3. SILKWORM PATHOLOGY SECTION

3.3.3.1. BAR (PS) 002: Formulation of broad spectrum room disinfectant for silkworm disease management. (Aug., 2011- July, 2013)

S. Chakrabarty (PI) and A. K. Saha

Objective: To formulate a broad spectrum, cost effective, less hazardous and eco-friendly fumigant room disinfectant. Disease management in silkworm crops and increase of cocoon productivity.

Two fumigant chemicals were screened under based on *in vitro* and *in vivo* studies. *In vivo* studies of twelve formulations (I–XII) prepared in different combinations with the two screened fumigant chemicals were completed and pool data analysis revealed that formulation X was the most effective (*Rank 1 : Smith Index*) in inactivating all the common pathogens, *Nosema bombycis*, *BmNPV*, *Beauveria bassiana* and bacterial suspension used in the experiment (Table 16).

Table 16. Performance of room disinfectant on silkworm rearing.

Formulation	Chemical (%)		V wt. (g)	ERR (%)	SCW (g)	SSW(g)	Shell (%)	Rank
	I	II						
I	10	90	1.550	90.36	0.762	0.088	11.48	6
II	20	80	1.560	83.42	0.754	0.086	11.35	7
III	30	70	1.570	92.94	0.745	0.091	12.20	5
IV	40	60	1.062	42.75	0.940	0.112	11.94	10
V	50	50	1.000	61.00	0.859	0.082	9.60	13
VI	60	40	1.045	52.75	0.927	0.100	10.76	9
VII	70	30	1.390	80.88	0.757	0.091	11.99	8
VIII	75	25	1.380	77.60	0.708	0.064	9.08	12
IX	80	20	1.480	75.88	0.692	0.063	9.03	13
X	85	15	1.950	98.25	0.968	0.149	15.39	1
XI	90	10	1.800	97.50	0.964	0.155	16.12	2
XII	95	5	1.770	96.75	0.946	0.132	13.93	3
In vivo	Control (5% B. powder)		1.570	75.75	0.921	0.116	12.64	4
	Mean		1.440	78.91	0.842	0.100	11.96	
	SD		0.330	16.92	0.100	0.030	2.11	
Criterion 1			3	3	3	3	3	
Criterion 2			10	10	6	6	6	

In room studies of twelve disinfectant formulations were obtained similar results (Rank 1: *Smith Index*) were obtained. First trial of comparative study of new disinfectant formulation (X) with existing room disinfectants observed that rearing performance with new fumigant formulation was more effective (*Smith Index: Rank*



1). Its performance in cocoon characters was *at par* with other available room disinfectants (5 % bleaching powder solution, chlorine dioxide etc.) (Table 17).

Table 17. Efficacy of newly formulated fumigant room disinfectant.

Treatment	Larvae wt.	ERR (No.)	SCW (g)	SSW (g)	Shell (%)	FL (m)	NBFL (m)	Denier	Rank
Formulation (X)	2.17	94	0.99	0.112	11.31	287.00	250.83	2.57	1
5% B.P	2.15	93	1.19	0.113	9.55	262.50	219.00	2.59	2
Chlorine dioxide	2.09	85	1.01	0.119	11.81	277.50	261.00	2.57	3
Mean	2.14	91	1.06	0.110	10.89	275.67	243.61	2.58	
SD	0.04	3.75	0.09	0.00	0.97	10.09	17.89	0.01	
Criterion 1	3	3	3	3	3	3	3	3	
Criterion 2	10	10	6	6	6	6	6	6	

3.3.3.2. BAR (RP) 005: Survey and surveillance of silkworm diseases in traditional sericultural districts of West Bengal. (April, 2012 to March, 2013)

S. Chakrabarty (PI), A. K. Dutta, (REC, Mothabari), A. K. Verma (Sub-REC, Rajmahal), D. Pandit (REC, MPraj), S. P. Chakrabarti (REC, Kamnagar), I/C, REC Bademaranga and REC Deogarh.

Objectives: To suggest on spot effective remedial measures to the farmers to control the disease and forewarn the farmers for ensuing commercial crop in West Bengal. To prepare database on the incidence of various diseases of silkworm, *Bombyx mori* during commercial crops in the traditional sericultural districts of West Bengal.

Crop wise survey of silkworm diseases was conducted at 48 villages by 214 farmers in three districts Murshidabad, Malda and Birbhum in West Bengal. Incidence of grasserie was recorded 2-5% during March-April, 1.5 to 7% in Aug.-Sept. and 11-13.2 % in February in three districts of West Bengal. In **Murshidabad**, maximum crop loss (~14.2%) and (~42%) was reported due to incidence of Muscardine disease during March-April and Feb. crops respectively at Balaspur area; Gattine (16.2%) during March-April and grasserie (11%) during February crop. In **Birbhum**, high incidence (~13.2%) of grasserie was recorded during Feb. crop. High incidence of Muscardine (~20.2%) and Gattine (~20.3 %) was recorded during March-April crop. In **Malda**, high incidence of Gattine (~13.05%) was observed during March-April crop, Flacherie (~16.6%) and Muscardine (~23.3 %) during Feb. crop. Proper disinfection of rearing house and rearing appliances, maintenance of temperature & relative humidity, providing quality & fresh mulberry leaves and maintenance of hygiene in the rearing house along with other important precautionary measures were suggested to the farmers.



3.4. COST REDUCTION

3.4.1. AGRONOMY SECTION

3.4.1.1. BPP (RP) 001: Mother culture maintenance of *Azotobacter chroococcum* and mass multiplication for Nitrofert production. (Micro project) (April, 2012 to March, 2013) (Continuous).

S. Rajaram (PI)

Objective: To reduce Nitrogenous chemical fertilizer requirement and expenditure to sericulture farmers in mulberry cultivation; to protect and improve soil health conditions in mulberry garden for sustainable productivity.

A total of 515 sericulture farmers of Eastern and North Eastern regions with in about 195 acres of mulberry applied 1531 kg of Nitrofert bio-fertilizer and improved soil fertility in their mulberry garden in an eco-friendly manner. Details of implementation of the programme are:

Nitrofert production & supply			
Particulars	Unit	Rate	Amount (Rs.)
Production details			
Opening Balance (kg)	139.27	25	3481.75
Production [2012-13] (kg)	1436.11	25	35902.75
Total	1575.38	25	39384.50
Sale proceed details			
Total quantity supplied (kg)	1530.85	25	38271.25
Mulberry area covered (acre)		194.50	
Number of farmers covered		515	
Closing Balance			
Closing Balance Nitrofert (kg)	44.53	25	1113.25
Total Expenditure			18327.33
Cost of production / kg #			12.76
# (Without establishment charges including wage)			

3.4.1.2. BPP(RP) 002: Mother culture maintenance of *Glomus mosae* [Arbuscular Micorhizal Fungus (AMF)] and mass multiplication for Phosphofert production. (Micro project) (April, 2012 to March, 2013) (Continuous)

S. Rajaram (PI)

Objective: To reduce Phosphorous chemical fertilizer and expenditure on the same to sericulture farmers in mulberry cultivation; to protect and improve soil health conditions in mulberry garden for sustainable productivity.



A total of 92 sericulture farmers of Eastern and North Eastern regions with 32.5 acres of mulberry applied 968 kg of Phosphofert bio-fertilizer and improved the soil fertility in their mulberry garden in an eco-friendly manner. Details of implementation of the programme are:

Phosphofert production & supply			
Particulars	Unit	Rate	Amount (Rs.)
Production details			
Opening Balance (kg)	0	25	0.00
Production [2012-'13] (kg)	1016	25	25400.00
Total	1016	25	25400.00
Sale proceed details			
Total quantity supplied (kg)	968	25	24200.00
Mulberry area covered (acre)	32.50		
Number of farmers covered	74		
Closing Balance			
Closing Balance Nitrofert (kg)	0	25	0.00
Total Expenditure	2495.00		
Cost of production / kg #	2.46		
# (Without establishment charges including wage)			

3.4.2. REELING & SPINNING DIVISION

3.4.2.1. BAI (P) 014: Studies on the reelability of multivoltine hybrid cocoons during adverse climatic condition in Eastern and North-Eastern region. (July, 2011 to March, 2014)

N. B. Kar (PI), A.K. Saha and D. Chakravarty

Objective: To find out proper reasons for poor reelability of multivoltine hybrid cocoons in adverse seasons. To explore the possibilities of improvement of reelability by manipulating the process technique. To explore the possibilities of improvement of reelability by incorporation of modest changes in the original design of the machine. To suggest for remedial measures for improving the reelability.

Treatment:

T₁ = 3-5 minutes boiling + reeling in boiling water (Control)

T₂ = 10 minutes steaming + 5 minutes boiling at 90⁰ C + reeling in hard water at 80⁰ C

T₃ = 20 minutes steaming + 5 minutes boiling at 90⁰ C + reeling in hard water at 80⁰ C

T₄ = 30 minutes steaming + 5 minutes boiling at 90⁰ C + reeling in hard water at 80⁰ C

T₅ = 40 minutes steaming + 5 minutes boiling at 80⁰ C + reeling in hard water at 60⁰ C

T₆ = 50 minutes steaming + 5 minutes boiling at 80⁰ C + reeling in hard water at 60⁰ C

T₇ = 60 minutes steaming + 5 minutes boiling at 80⁰ C + reeling in hard water at 60⁰ C



Table 18. Reeling performance of silkworm hybrids.

Treatment	AFL (m)	NBFL(m)	Denier	Reelability %	
Hybrid: N x M12(W) (Traditional rearing practice)				2 nd Crop	3 rd Crop
T1	2 nd Crop			36	60
T2				51	67
T3	304	133	2.39	52	65
T4	3 rd Crop			51	64
T5				47	61
T6	324	180	2.44	60	60
T7				51	59
Hybrid: N x M12(W) (Improved rearing practice)					
T1	2 nd Crop			28	61
T2				55	68
T3	332	176	2.28	45	65
T4	3 rd Crop			46	66
T5				44	60
T6	313	131	2.58	131	2.58
T7				47	60

Treatment	AFL (m)	NBFL(m)	Denier	Reelability %	
Hybrid: M.Con.1 x M.Con.4 (Traditional rearing practice)				2 nd Crop	3 rd Crop
T1	2 nd Crop			27	39
T2				45	52
T3	494	215	2.26	42	49
T4	3 rd Crop			45	48
T5				42	47
T6	364	130	2.57	44	45
T7				42	45
Hybrid: M.Con.1 x M.Con.4 (Improved rearing practice)					
T1	2 nd Crop			40	42
T2				58	51
T3	526	202	2.51	47	45
T4	3 rd Crop			43	49
T5				41	45
T6	420	161	2.62	37	44
T7				46	46

Results revealed that overall reeling performance with the improved practice of rearing was better than the traditional practice irrespective of silkworm hybrids and treatments. The treatment T2 showed better performance over other treatments while other treatments, T3, T4, T5, T6 and T7 showed close proximity to each other. The study was envisaged to support the reelers to utilize multivoltine hybrid cocoons more efficiently to produce better silk and higher reelability and production efficiency during adverse climatic conditions.



3.B. ONGOING RESEARCH PROJECTS & PROGRAMMES OF REGIONAL SERICULTURAL RESEARCH STATIONS

3.B.1. KALIMPONG

3.B.1.1. B-KPG(P) 015: Improvement of rearing technology for autumn crop in sub- Himalayan region. (Aug., 2012 to Jan., 2014)

R. Bhutia (PI)

Objectives: To simplify the rearing technology with an aim towards reducing inputs both in respect of labour and mulberry leaves by introducing branch/ twig feeding during autumn crop. To utilize the limited quantity of food resources effectively for the production of better and higher crop by introducing shoot rearing technique.

Rearing conducted with shoot feeding from 4th instar of bivoltine hybrid SK6 x SK7 during autumn (Aug.-Sept.) season showed higher shell ratio (18.9%) and cocoon yield/ 100 dfls (47.4 kg) than the plucked leaf feeding (18.5% and 45 kg, respectively).

3.B.1.2. B-KPG(P)-006: Muga Seed Multiplication Prog. (*Collaborative prog. with MSSO, Guwahati*) (Nov., 2009 to Oct., 2014)

M. D. Maji (PI)

Regional Sericultural Research Station, Kalimpong is entrusted with an additional mandate of Muga Seed Multiplication Programme in collaboration with Muga Silkworm Seed Organization (MSSO), Guwahati in the year 2009. Under this programme, establishment of muga host plants is in progress, besides maintenance of 8 acres of Som and Soalu plantation (4000 plants) at Hill Nursery taken on lease for three years from DoT (Seri), West Bengal to conduct muga silkworm rearing.

Muga plantation: Newly established plantation (4000 plants of Som and Soalu) at Kalimpong farm and Hill nursery was maintained.

Rearing: Under sub-tropical hills of Kalimpong, muga silkworm required 28 days from brushing to spinning. Weight of mature larvae was 12.9 g. A total of 12,310 cocoons were harvested @ 31 cocoons/ dfls. Cocoon wt. and shell wt. were 5.8 g and 0.6 g respectively with the shell ratio of 9.7%.

Grainage: A total of 11,510 cocoons were processed for grainage. Emergence of moths was started on 22nd day from the date of spinning. A total of 4541 male and 2294 female moths were emerged, 2129 pairing was obtained and a total of 1930 dfls (1992 g) were produced with the fecundity of 136 egg/ dfls. The dfls were supplied to MSSO, Guwahati, Assam.



3.B.2. KORAPUT

3.B.2.1. B-KPT(P)17: Assessment of fertility status of mulberry growing soils in selected seri-villages of Koraput for appropriate fertilizer management (Jan., 2012 to Dec., 2013)

S. K. Misro (PI)

Objectives: To study the NPK content of the soils of the region. Standardization of the supplemented NPK for Kalahandi, Balangir and Koraput regions of Odisha state.

Soil samples collected from the farmers field of Koraput (Bayaput 5, Sagar 1 and Sukriguda 1) and Rayagada (Ratapada 2, Siriguda 10, Bhagamunda 5 Khurigaon 6) districts of Odisha were tested for NPK, pH and EC. Recommendations of chemical fertilizer were made as per ready reckoner and accordingly supplied to the farmers for application in the mulberry fields. Average leaf yield gain recorded was 9.1% and 6.8% in the test based and recommended dosages of fertilizer application respectively, against the control yield of 2.2 mt/ha during Feb.-March crop.

3.B.3. RANCHI

3.B.3.1.B-RNC(RP)004: Survey & surveillance of disease and pest of mulberry and silkworm. (April, 2012 to March, 2013) [CONCLUDED]

A.H. Naqvi (PI)

Objective: To assess the incidence of different diseases and pests periodically and to take control measures.

Incidence of grasserie was recorded in all the three seasons i.e. Feb.- March (1.2%), August (2.4 %) and October (2 %) followed by flacherie 1%, 1% and 0.9% respectively. Mulberry foliar disease incidence was recorded and severity of Powdery mildew was 2.73 PDI in the month of November.

3.B.3.2.B-RNC(VP)007: Validation trial of package of nutrient under rainfed condition. (Oct., 2011 to Oct., 2013)

Ghanshyam Singh (PI)

Objective: To validate the integrated nutrient management (INM) package for increasing leaf productivity.

The INM package (NPK @75:50:50 kg/ha/yr + Vermicompost @ 10 mt/ ha/ yr + Azotobacter @10 kg/ha/yr) tested at farmers' field revealed that mulberry leaf yield gain during August, October and Feb.-March crops was 3.5 to 9.7% against the control yield of 2.8 mt, 2.9 mt and 2.9 mt respectively.



3.B.3.3. B-RNC (P) 18: Assessment of fertility status of mulberry growing soils in selected seri-villages of Ranchi for appropriate fertilizer management (Jan., 2012 to Dec., 2013)

Ghanshyam Singh (PI)

Objective: To prepare fertility rating chart of mulberry growing soils adjacent to Ranchi through soil testing at farmer's level. To popularize the 'soil test based' fertilizer application among farmers as per the fertility rating chart developed.

Soil samples collected from thirty farmers' were analyzed and recommended doses of chemical fertilizers were applied in October crop. Leaf yield recorded in soil test based fertilizer application was 3.1 mt/ha/yr. which was 10% more than the general recommendation.

3.B.4. JORHAT

3.B.4.1. MOE 3459: Yield gap in mulberry sericulture- a study in North Eastern region of India. (Oct., 2011 to Sept., 2014)

M. Pamehgam (PI) and M. Sankar.

Objectives: To study the socio economic profile of the farmers of North Eastern India. To determine the yield gap at farmers' level as compared to the institute level and demonstration plots. To identify different factors responsible for such yield gap. To suggest possible options for reducing the gap.

Selections of surveyed areas and respondents were done and tentative structure schedule prepared. Information on age, educational status, occupations, land holding and rearing capacity of the farmers were collected from 300 farmers covering 80 villages from Assam, Nagaland, Manipur, Mizoram, Meghalaya and Tripura. Preliminary data were compiled and it revealed that 37% of the respondents were male and 63% as female; 12.3% under the age group of 30 years, 33.7% under 40 years, 30.7% under 50 years, 17% under 60 years and remaining 6.3% above 70 years of age group. The educational level of the respondents was primary (45.3%), secondary (24%), higher secondary (13.3%) and 0.7% was graduate level. However, 22.3% of the respondents were illiterate. It was also observed that all the respondents were engaged in sericulture, 83.7% in agriculture along with sericulture. 4.7% do petty business with minimum income and 1% engaged in service (salaried) although they are engaged in sericulture. Average land holding for sericulture was 41% with below 0.5 acres and 59% with more than 0.5 acres per farmers. About 78% of the respondents adopted 90 cm x 90 cm spacing for mulberry plantation and remaining 22% farmers with other spacing. The respondents adopted high yielding mulberry variety, S-1635 from all the states balancing with other high yielding mulberry varieties namely S1 in Tripura and K2 and TR10 in Manipur, BC259 in Mizoram



and Jatinuni in Assam. Mulberry leaf yield was 7 - 12 mt/ha/yr. Around 67% of the respondents adopted middle pruning, 13% top pruning and 20% bottom pruning. Moreover, 95% of respondents didn't apply chemical fertilizers in their mulberry garden.

3.B.4.2. B-JRH(P)019: Assessment of fertility status of mulberry growing soils in selected seri-villages of Jorhat for appropriate fertilizer management. (April, 2011 to March, 2014)

S. N. Gogoi (PI)

Objective: To know the initial fertility status (PH, EC, organic carbon, N, P and K) of the mulberry growing soils for better fertilizers management.

Twenty soil samples from the mulberry gardens of farmers' of Jorhat district were collected and estimated the pH, electrical conductivity, organic carbon, nitrogen, phosphorus and potash. The nutrient contents in the soil samples showed wide variation in different mulberry gardens. Soil pH ranged between 4.8 and 6.9, EC (0.35-0.27), Organic Carbon (0.2-1.6) and N (132.6-234.8 kg), P (9.4-21.3 kg) and K (36.5-240 kg). After analyzing the soil samples, NPK recommendations were advocated to the farmers for mulberry plantation.

3.B.4.3.B-JRH(P)011: Studies on the biology efficiency of the coccinellid predator, *Scymnus posticalis* sicard for management of whitefly on mulberry. (April, 2011 to March, 2013) [CONCLUDED]

Y. Debaraj (PI) and S. N. Gogoi

Objective: To study the biology and feeding efficiency of the coccinellid predator, *Scymnus posticalis* Sicard.

Biology and feeding efficiency studies of the coccinellid predator revealed that the egg hatched in 4.9 days, larval development (1- 4 instars) completed in 13.7 days, pre-pupa and pupa took 2.1 days and 7.3 days, respectively. Life cycle (egg to adult) of the predator feeding on mealy bug eggs and nymphs was completed in 28 days. Duration of development and measurement of different stages of the predator are depicted in Table 19. The copulation and oviposition periods of the predator took around 7 minutes and 24 day respectively. Longevity of male and female adults was 27 and 32 days respectively. The feeding efficiency studies of the predator on white fly eggs and nymphs revealed that a predator larva consumed 487 eggs or 163 nymphs of whitefly. An adult male predator consumed 986 eggs or 335 nymphs and a female consumed 1210 eggs or 424 nymphs of whitefly.



Table 19. Developmental period and sizes of the predator *Scymnus posticalis* (Mean \pm SD)

Life stages	Developmental period	Measurement (mm)	
		Length	Breadth
I. Egg	4.93 \pm 0.75	0.38 \pm 0.03	0.20 \pm 0.024
II. Larva	2.56 \pm 0.44	0.53 \pm 0.05	0.17 \pm 0.017
I – instar			
II – instar	2.86 \pm 0.65	1.57 \pm 0.19	0.76 \pm 0.07
III – instar	3.73 \pm 0.70	2.54 \pm 0.19	1.27 \pm 0.05
IV – instar	4.58 \pm 0.46	3.49 \pm 0.26	1.60 \pm 0.19
III. Pre Pupa	2.08 \pm 0.60	3.38 \pm 0.36	1.58 \pm 0.19
III. Pupa	7.30 \pm 0.77	3.53 \pm 0.35	2.10 \pm 0.22
IV. Adult : Male	27.71 \pm 2.87	1.88 \pm 0.06	1.16 \pm 0.03
Female	32.57 \pm 3.10	2.56 \pm 0.05	1.24 \pm 0.03

3.C. COLLABORATIVE RESEARCH PROJECTS /PROGRAMMES WITH RSRs & RECs

3.C. 1. SOIL SCIENCE & CHEMISTRY SECTION

3.C.1.1. PPS3435: Studies on micronutrients for sustained high productivity of quality mulberry in Eastern and North-Eastern India. (Jan., 2010 to June, 2013)

S. K. Majumder (PI upto 19.05.2012), R. Kar (PI from 20.05.2012), S. Chatterjee, A. H. Naqvi, S. K. Misro and S. N. Gogoi

Objectives: To evaluate the micro-nutrients' status of mulberry growing soils and of mulberry as well as their order of requirement. To work out the recommendation for individual micronutrient through the exercise on multilocal leaf productivity along with the order of micronutrient requirement by mulberry under appropriate statistical package of DRIS.

Mulberry leaf productivity data were recorded at 372 units of 124 sites under Eastern and North-Eastern regions along with chemical analysis of leaf samples for estimation of micronutrients i.e. zinc, copper, iron and manganese. Based on the chemical analysis, site specific micronutrient ratios were computed and presented below (Table 20).



Table 20. Micronutrient ratios of mulberry leaf of Eastern and North-Eastern India.

Location	Micronutrient ratios					
	Cu/Zn	Fe/Zn	Mn/Zn	Fe/Cu	Mn/Cu	Fe/Mn
West Bengal Plains	0.37±0.03 (0.17-0.94)	7.92±0.64 (3.55-15.32)	2.68±0.36 (0.92-9.68)	22.31±1.70 (6.11-44.60)	7.37±0.78 (0.98-20.43)	3.56±0.35 (1.09-8.05)
West Bengal Hills	0.26±0.02 (0.10-0.41)	4.88±0.95 (0.34-21.56)	3.29±0.44 (0.49-8.00)	17.64±2.41 (1.43-41.46)	13.61±2.05 (2.45-38.90)	1.79±0.34 (0.16-8.62)
Odisha and Jharkhand	0.36±0.05 (0.09-1.29)	7.84±0.93 (2.69-16.10)	6.83±0.96 (0.53-15.07)	29.18±4.30 (3.66-64.03)	20.77±2.93 (2.85-55.55)	3.47±1.16 (0.25-21.67)
North Eastern states	0.24±0.01 (0.07-0.37)	3.92±0.32 (0.77-9.08)	2.89±0.21 (0.31-9.16)	17.01±1.41 (3.14-55.25)	13.23±1.22 (1.08-55.69)	1.53±0.13 (0.24-4.09)

The micronutrient ratios of mulberry leaf tissues were, further, exercised under an orthogonal mathematical model to work out the DRIS functions (f) as follows:

$$f(A/B) = [(A/B)/(a/b) - 1] \times 1000/CV, \text{ when } A/B \geq a/b \dots\dots\dots (1) \text{ or}$$

$$f(A/B) = [1 - (A/B)/(a/b)] \times 1000/CV, \text{ when } A/B < a/b \dots\dots\dots (2)$$

A/B is the tissue micronutrient ratio of the plant to be diagnosed, a/b is the optimum value or norm for that given ratio and CV is the coefficient of variation associated with the norm. The enumerated DRIS functions (f) for leaf micronutrient ratios are :

Table 21. DRIS functions (f) for leaf micronutrient ratios

Location	DRIS functions (f)					
	f (Cu/Zn)	f (Fe/Zn)	f (Mn/Zn)	f (Fe/Cu)	f (Mn/Cu)	f (Fe/Mn)
West Bengal Plains	-31.96 to +40.46	-29.77 to +22.64	-28.29 to +38.68	-68.24 to +25.73	-121.96 to +33.02	-45.48 to +25.16
West Bengal Hills	-46.36 to +29.39	-135.73 to +34.57	-83.78 to +20.96	-162.98 to +19.39	-59.33 to +24.20	-107.33 to +39.27
Odisha and Jharkhand	-43.48 to +37.44	-34.28 to +18.86	-176.78 to +18.31	-100.95 to +17.29	-95.12 to +25.33	-82.19 to +33.46
North Eastern states	-76.25 to +17.97	-72.75 to +23.3	-158.62 to +41.91	-76.17 to +38.77	-174.34 to +49.64	-88.78 to +28.01

The DRIS indices for the individual micronutrient will be computed through the appropriate exercise upon the values of DRIS functions (f) and the same will, further, be exercised with multilocal leaf productivity to work out the order of micronutrient requirement by mulberry.



3.C. 2. ENOTOMOLOGY SECTION

3.C.2.1. BPR (P) 021: Development of weather based forecasting models for mulberry pests. (Jan., 2011 – Dec., 2015)

S. K. Mukhopadhyay (PI), M.V. Santha Kumar, M. Patnaik, N. K. Das, J. Sarkar, REC, Mothabari (West Bengal), N. R. Rao, RSRS, Koraput (Odisha), Y. Devaraj, RSRS, Jorhat (Assam).

Objectives: To develop a data base on climatic factors and incidence of major pests of mulberry. To establish pest incidence and weather relationship. To develop region wise forecasting models for different pests of mulberry.

Incidence of major mulberry pests were recorded at the Institute's field, three traditional districts of Gangetic plains (Malda, Murshidabad and Birbhum) and Kalimpong hills of West Bengal at weekly intervals. At the institute's plot, thrips incidence prevailed during the month of May to Sept. and max. population was recorded during Sept. (15/leaf) with recurrence during March. Whitefly population was recorded during Oct. and Nov. and max. population of 14/leaf during Oct. In Murshidabad district, thrips population was from April to August, due to prevailing drought with max. population of 35/leaf during May. In all months, white fly population was above ETL and with the rising of temperature, it again appeared during March. White fly population recorded during August to Oct. and max. population (14/leaf) was recorded during August. In Birbhum district, same trend of incidence of white fly was recorded but population level was low. Max. population of thrips was recorded during April (17/leaf) and whitefly 5/leaf during October. In Malda district, thrips population was recorded during the April to June, 2012 but at a low level, while white fly recorded during July, August and October with a range of 6 to 8/leaf. Tukra incidence was also recorded during July-August, 2012. In Kalimpong hills incidence of root mealy bug prevailed throughout the year and low level ranging between 3/plant during August and 0.3/plant during December.

Pest incidence data recorded at the farmers' field and at RSRS, Jorhat (Assam) and RSRS, Koraput, Odisha revealed that in Jorhat, thrips population (3/leaf) was recorded during April and whitefly population during August to Nov. with max. population of 47/leaf during September. Moreover, Tukra incidence was recorded during April and May. In Koraput, all the major pests viz. thrips, white fly and mealy bug were observed throughout the year but in a very low level. Thrips population was observed between 0.4 and 4/leaf, while white fly population ranged between 0.3 and 4/leaf. Tukra incidence was 0.3-4%.



Spray schedule developed for controlling mulberry diseases in Eastern and North Eastern states

MULBERRY DISEASE FOREWARNING

MURSHIDABAD (W.B.)

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Week	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Pruning												
PMLD												
BLS #												
MLS #												
PLS #												
LR												
Sp.Schd												

denotes above ETL. Spray Schedule may change +/- one week as per brushing of dfls and safe period

MALDA (W.B.)

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Week	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Pruning												
PMLD												
BLS												
MLS #												
PLS												
LR												
Sp.Schd												

denotes above ETL. Spray Schedule may change +/- one week as per brushing of dfls and safe period

BIRBHUM (W.B.)

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Week	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Pruning												
BLS #												
MLS												
PLS												
Sp.Schd												

denotes above ETL.

Carbendazim 0.1% @ 180 litre / acre (safe period 5 - 7 days).

Plantomycin 0.01% @ 180 litre / acre (safe period 15 days).

Spray Schedule may change +/- one week as per brushing of dfls and safe period



KALIMPONG (W.B.)

MONTH	JAN				FEB				MAR				APR				MAY				JUN				JUL				AUG				SEP				OCT				NOV				DEC			
Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Pruning																																																
PMLD																																																
LR #																																																
YLR																																																
Sp.Schd																																																

denotes above ETL.

KORAPUT (ODISHA)

MONTH	JAN				FEB				MAR				APR				MAY				JUN				JUL				AUG				SEP				OCT				NOV				DEC			
Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Pruning																																																
PMLD																																																
MLS																																																
LR #																																																
Sp.Schd																																																


denotes above ETL.

JORHAT (ASSAM)

MONTH	JAN				FEB				MAR				APR				MAY				JUN				JUL				AUG				SEP				OCT				NOV				DEC			
Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Pruning																																																
PMLD																																																
MLS																																																
LR																																																
Sp.Schd																																																

No disease is above ETL.

 Carbendazim 0.1% @ 180 litre / acre (safe period 5 - 7 days).

 Mancozeb 0.2% @ 180 litre / acre (safe period 7 - 10 days).

Spray Schedule may change +/- one week as per brushing of dffs and safe period



RANCHI (JHARKHAND)

MONTH	JAN				FEB				MAR				APR				MAY				JUN				JUL				AUG				SEP				OCT				NOV				DEC			
Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Pruning																																																
PMLD																																																
Sp.Schd																																																

No disease is above ETL.

AIZAWL (MIZORAM)

MONTH	JAN				FEB				MAR				APR				MAY				JUN				JUL				AUG				SEP				OCT				NOV				DEC			
Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Pruning																																																
PMLD																																																
MLS																																																
LR																																																
Sp.Schd																																																

No disease is above ETL.

RANGPOO (SIKKIM)

MONTH	JAN				FEB				MAR				APR				MAY				JUN				JUL				AUG				SEP				OCT				NOV				DEC			
Week	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Pruning																																																
PMLD																																																
LR																																																
Sp.Schd																																																

No disease is above ETL.

 Carbendazim 0.1% @ 180 litre / acre (safe period 5 – 7 days).
 Mancozeb 0.2% @ 180 litre / acre (safe period 7 – 10 days).

Spray Schedule may change +/- one week as per brushing of dffs and safe period



MAHESHPUR RAJ (JHARKHAND)

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Week	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Puning												
PMLD#												
MLS#												
LR#												
SpSchd												

No disease is above ETL.

 Carbendazim 0.1% @ 180 litre / acre (safe period 5 – 7 days).

 Plantomycin 0.01% @ 180 litre / acre (safe period 15 days).

Spray Schedule may change +/- one week as per brushing

DIMAPUR (NAGALAND)

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Week	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Puning												
PMLD#												
MLS#												
LR#												
SpSchd												

denotes above ETL.

 Carbendazim 0.1% @ 180 litre / acre (safe period 5 – 7 days).

 Mancozeb 0.2% @ 180 litre / acre (safe period 7 – 10 days).

Spray Schedule may change +/- one week as per brushing of dfls and safe period

IMPHAL (MANIPUR)

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Week	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Puning												
MLS												
LR												
SpSchd												

No disease is above ETL.



AGARTALA (TRIPURA)


MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Week	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Pruning												
PMLD#												
MLS												
PLS												
Sp.Schd												
# denotes above ETL.												

SINGHANPUR (CHATTISGARH)

MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Week	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
Pruning												
MLS												
LR												
Sp.Schd												

No disease is above ETL.

 Carbendazim 0.1% @ 180 litre / acre (safe period 5 – 7 days).

 Mancozeb 0.2% @ 180 litre / acre (safe period 7 - 10 days).

Spray Schedule may change +/- one week as per brushing of dfls and safe period.



3. D. CONCLUDED RESEARCH PROJECTS / PROGRAMMES

3. D.1. RAINFED SERICULTURE: Nil

3. D.2. PRODUCTIVITY IMPROVEMENT

3. D.2.1. SILKWORM PHYSIOLOGY & RTI SECTION

3. D.2.1.1. BPP (VP) 003: Validation trial on the superiority of paired row plantation in chawki mulberry garden with regard to leaf yield and cocoon productivity. (Oct., 2010 to Sept., 2012)

T. Datta (Biswas) (PI), Tapas Nath, Shivnath, P. K. Biswas, P. Kar and N. B. Kar.

Objective: Validation of the finding of the project PPA 3366 *i.e.* superiority of paired row planting system [(150 cm + 90 cm) x 60 cm] for production of quality mulberry leaf with respect to the young age silkworm rearing before recommendation.

Treatments: **T0** [60 cm x 60 cm spacing + 40 mt FYM /ha/yr + NPK @ 236: 180: 112 kg /ha/yr.]; **T1** [(150 cm+90 cm) x 60 cm spacing + 40 mt FYM/ha/yr + NPK @ 236:180: 112 kg /ha/yr].

A: Effect of plant geometry on chawki leaf production.

T0 = Chawki rearing with mulberry leaves from control plot (60 cm x 60 cm) and late age rearing with normal mulberry leaves; **T1** = Chawki rearing with mulberry leaves from [(150 cm + 90 cm) x 60cm] plot and late age rearing with normal mulberry leaves. Leaf yield per hectare per year was recorded *at par* in paired row plantation [(150 cm + 90 cm) x 60 cm] and (60 cm x 60 cm) spacing in all the three test centres (16.2 & 16.8 mt at P1 BSF Karnasubarna, 14.5 & 14.9 mt at DoT (Seri), Farm Akherighata and 15.2 & 15.7 mt at P1 BSF, Banguria) although the number of plants per hectare was double in 60 cm x 60 cm spacing *i.e.* 27777 against 13888 in paired row system respectively (Table 22)

B. Effect of planting geometry on cocoon production, BSF Karnasubarna: Pooled data of one year of multivoltine breed revealed that ERR% (80.5% and 72.1%), cocoon yield /100 dfls (32.3 kg and 28.6 kg), Shell% (12.2 and 11.8), filament length (303.8 m and 280.3 m) and reelability% (74.0 and 72.8) were significantly higher with paired row plantation [(150 cm + 90 cm) x 60 cm] in comparison to 60 cm x 60 cm plantation.

At DoT (Seri.), Akherighata farms, silkworm rearing of multivoltine breeds revealed that ERR% (81.9 % and 76.2%), cocoon yield/100 dfls (33.6 kg and 30.5 kg), Shell% (12.4 and 11.9), filament length (303 m and 282 m) and reelability% (75 and 73) were significantly higher with paired row plantation [(150 cm + 90 cm) x 60 cm] than the 60 cm x 60 cm plantation.



At BSF Banguria, rearing of multivoltine breeds revealed that ERR% (72 % and 62%), cocoon yield /100 dfls (32 kg and 27 kg), filament length (407 m and 386 m) and reelability% (68 and 65) were significantly higher in paired row plantation [(150 cm + 90 cm) x 60 cm] spacing than the 60 cm x 60 cm plantation.

Rearing of bivoltine breeds revealed that ERR% (85 % and 78%), cocoon yield/ 100 dfls (54 kg and 48 kg), filament length (751 m and 701 m) and reelability% (74 and 73) were significantly higher with paired row plantation in comparison to 60 cm x 60 cm plantation (Table 23).

Table 22. Effect of planting geometry on chawki leaf yield of mulberry.

Village	Treat.	Leaf yield/ha/crop (mt)					Total (mt/ha/yr)
		June - July, 2011	Oct.- Nov., 2011	Feb.- Mar., 2012	May- June, 2012	July- Aug., 2012	
Karnasubarna	T1	4.07	3.21	1.91	2.30	4.75	16.2
	T 0	4.22	3.38	2.02	2.36	4.78	16.8
	t test	NS					
Akherighata	T1	3.35	2.31	2.27	2.52	4.01	14.5
	T 0	3.50	2.35	2.36	2.63	4.09	14.9
	t test	NS					
Banguria	T1	3.59	2.43	2.18	2.54	4.46	15.2
	T 0	3.64	2.46	2.22	2.64	4.69	15.7
	t test	NS					

**Table 23. Effect of planting geometry on rearing and reeling performance.
(Pooled data of one year)**

Village	Treat.	ERR (%)	Yield/ 100 dfls (kg)	Shell (%)	FL (m)	Reelability (%)
Karnasubarna (Multi)	T1	80.5	32.3	12.18	303.8	74.0
	T0	72.1	28.6	11.78	280.3	72.8
	t value	5.913**	6.5196**	3.532*	2.687*	4.065*
Akherighata (Multi)	T1	81.9	33.6	12.4	303.3	74.6
	T0	76.2	30.5	11.9	282.4	72.9
	t value	5.627**	7.296**	3.499*	3.579*	4.347**
Banguria (Multi)	T1	72.5	32.2	12.6	407.6	68.5
	T0	61.9	27.0	12.7	386	64.9
	t value	4.486**	5.886**	NS	2.132**	2.132**
Banguria (Bi)	T1	84.9	53.8	18.7	751.0	74.4
	T0	78.1	48.1	18.8	700.9	72.8
	t value	3.798**	4.620**	NS	5.067**	NS



Rearing and reeling parameters of all the three test centers also clearly showed the superiority of paired row [(150 cm + 90 cm) x 60 cm] plantation over the 60 cm x 60 cm plantation.

Economics: An additional income of Rs. 516/- (Multi) and Rs. 1056/- (Bi) can be earned from rearing of 100 dfls by adopting paired row [(150 cm + 90 cm) x 60 cm] plantation in chawki mulberry garden in comparison to 60 cm x 60 cm plantation.

Sl. No.	Item	Economics
1.	Land required producing 20 kg chawki leaf to rear 100 dfls chawki rearing.	0.75 katha (545 sq ft.).
2.	Additional expenditure for FYM.	100 kg @ Re.0.90 /kg i.e. Rs.90.00
3.	Savings from application of 100 kg less Nitrogen.	1 kg @ Rs.6.00 i.e. Rs. 600.00
4.	Additional expenditure/100 dfls (Sl.No.2- 3)	Rs. 90.00 to Rs. 6.00 i.e. Rs. 84.00
5.	Additional cocoon yield / 100 dfls.	Multivoltine: 4 kg Bivoltine: 5.7 kg
6.	Gain from selling of additional cocoons @ Rs.150/- kg & 200/- per kg for multi & bivoltine seed cocoons.	Rs 600.00 (Multi) Rs 1140.00 (Bi)
7.	Net gain from 100 dfls /crop.	Rs. 516.00 (Multi) Rs.1056.00 (Bi)

3.D.2.1.2. Improvement of mulberry seed cocoon production at farmers' level with special reference to Bivoltine seed cocoon in West Bengal.
(Nov., 2011 to Oct., 2012) [DST funded project: *Collaboration with DoT (Seri), West Bengal and NSSO, Bangalore*]

T. Datta (Biswas) (PI), A. K. Saha, M. M. Banerjee and G. K. Chattopadhyay

Objectives: Stabilization and improvement of Bivoltine and Multivoltine seed cocoon crops especially during adverse crop of West Bengal and establishment of model seed rearers.

Methodology: Selection of operational area, Selection of adopted farmers, Imparting training to farmers, Supply of inputs to selected farmers, Crop supervision and guidance, Arranging awareness prog., workshop, Collection of rearing data, compilation and inference.



Three villages of Murshidabad district namely Kiriteswari, Banjetia and Kalitala Diara were selected in consultation with DoT (Seri) West Bengal and SSPC, Berhampore. A total of 50 farmers were selected from three villages i.e., Kiriteswari (25), Kalitala Diara (10) and Banjetia (15) in Murshidabad district. Two training prog. were arranged at the Institute for the adopted farmers on silkworm seed crop rearing. Fifty tones of FYM was distributed @ 1 mt /farmer. In addition, 2650 kg urea, 4100 kg SSP and 700 kg MOP were distributed to the farmers.

Each adopted farmer was supplied with 10 rearing trays, 10 chandrakies, 40 pieces of foam pads, 8 pieces of paraffin paper, 4 kg of bleaching powder and labex and 5 kg of lime. Quality DFLs were supplied to the adopted farmers through SSPC Berhampore and DoT (Seri), Murshidabad. Five seed crop rearing was conducted by the adopted farmers under close supervision from the Institute, DoT (Seri) West Bengal and SSPC Berhampore. Awareness programmes were arranged for the farmers on measures to be taken on the prevailing environmental condition. Workshop was arranged to get feed back from the stake holders after completion of the project.

Rearing performance at villages:

Banjetia village

Season	Breeds	Cocoon yield/ 100 dfls (kg)		Yield gain (kg / 100 dfls)	Yield gain (%)
		DST	Non DST		
Falguni P1 (Dec.– Jan.)	Bi	52	41.4	10.6	25.6
Baisakhi P1 (Feb.– Mar.)	Bi	50.6	36.2	14.4	39.8
Shravani P1 (May– Jun.)	Multi	23.2	20.5	2.7	13.2
Ashwina P1 (July – Aug.)	Multi	26	20.1	5.9	29.4
Agrahayani P1 (Sept.– Oct.)	Multi	28.6	25.4	3.2	12.6
Average		36.08	28.7	7.4	25.7
t value		2.635*			
Kalitala Diar village					
Falguni P1(Dec– Jan)	Multi	41.3	30.0	11.3	37.7
Baisakhi P1(Feb.– Mar)	Multi	40.4	30.2	10.2	33.8
Shravani P1(May–June)	Multi	22.0	20.0	2.0	10.0
Ashwina P1(July- Aug)	Multi	29.0	22.0	7.0	31.8
Agrahayani P1(Sept- Oct)	Multi	29.4	23.4	6.0	25.6
Average		32.4	25.1	7.3	29.1
t value		4.431**			



Kiriteswari village (Cocoon yield kg/ 100 dfls)

Season	Bivoltine		Gain (%)	Multivoltine		Gain (%)
	DST	Non DST		DST	Non DST	
Falguni P1(Dec.– Jan.)	53.07	43	10.07	36.9	25.1	11.08
Baisakhi P1(Feb.– Mar.)	39.6	33.2	6.4	36.6	20.8	15.8
Shravani P1(May– June)	32.7	15.0	17.7	22.8	19.6	3.2
Ashwina P1(July –Aug.)	18.0	15.5	2.5	25.0	21.9	3.1
Agrahayani P1(Sept.-Oct.)	24.0	18.5	5.5	24.5	18.5	6.0
Average	33.5	25.1	8.4	29.2	21.2	8.0
t value	3.951**			3.664**		

With supply of inputs as envisaged in the project an average annual income of an adopted farmer was Rs. 64,129/-, which was 38% more than the non-adopted farmers. At Kalitala Diar village, annual income of a farmer was Rs. 44,480/- with 16.8% and at Kiriteswari village, annual income was Rs. 46,512/- with 20.2% increased gain.

SALIENT OUTCOME OF THE PROJECT:

- ❖ Improvement in seed cocoon production (7 kg/100 dfls i.e. 28%) in spite of varied climatic conditions, in Bivoltine, the improvement was to be 32% more.
- ❖ During favourable crop seasons, improvement in cocoon yield was 28.5% while in unfavourable seasons the cocoon, yield gain was 26.5%.
- ❖ A glimpse of light for expanding Bivoltine Sericulture in West Bengal has been found by advocating Bivoltine seed cocoon production throughout the year at Kiriteswari village with an average cocoon yield of 33.5 kg/100 dfls.
- ❖ Upliftment of socio-economic condition (additional income) was about 25% at adopted seed rearers (16-38%) through enhancement of quality cocoon production.

3. D.2.2. SILKWORM BREEDING AND GENETICS SECTION**3. D.2.2.1. BAI (P) 009: Field level testing of new hybrids. (Jan.,11 to Dec., 12) [Concluded]**

H. Lakshmi (PI) (upto 06.12.2012), N. Suresh Kumar, A. K. Saha and G. K. Chattopadhyay

Objective: To evaluate the new hybrids under different field conditions.

Three multi x bi hybrids, M6DPC x D6PN, M6DPC x (D6PN x SK4C) and M6DPC x SK4C along with control N x NB4D2, the bi x bi hybrid D6PN x SK4C along with the control NB18 x P5 were field tested at 13 test centres during spring and autumn seasons. Among the multi x bi hybrids, M6DP(C) x D6PN showed an average cocoon yield of 65.7 kg/ 100 dfls, M6DP(C) x (D6PN x SK4C) by 65.8



kg/ 100 dfls and M6DP(C) x SK4C by 67.4 kg/ 100 dfls compared to the control (N x NB4D2) yield of 55.4 kg/ 100 dfls.

Table 24. Performance of Multi x Multi and Multi x Bi hybrids in different test centres (pooled data for two years-spring and autumn seasons)

Sl. No.	Name of the test centre	M6DPC x D6PN	M6DPC x (D6PN x SK4C)	M6DPC x SK4C	Nistari x NB4D2	D6PN x SK4C	NB18 x P5
1	RSRS, Jorhat	62.3	65.6	69.1	54.5	69.5	63.1
2	RSRS, Koraput	65.6	66.8	67.5	54.4	67.9	64.1
3	RSRS, Ranchi	66.3	65.6	68.1	53.5	66.5	65.3
4	REC, Shillong	69.0	72.8	70.6	60.6	73.3	69.5
5	REC, Aizawl	69.0	73.1	70.8	59.4	73.1	69.4
6	REC, Imphal	69.1	72.8	67.3	56.4	73.5	68.4
7	REC, Deogarh	-	-	-	-	67.9	65.4
7	REC, Mahespurraj	65.9	64.8	66.9	53.1	-	-
8	REC, Nabagram	64.5	65.6	65.0	53.9	-	-
9	REC, Mothabari	66.3	54.4	65.6	56.5	-	-
10	DoT (Seri), Malda	65.6	63.5	66.3	56.5	-	-
11	DoT (Seri), Murshidabad	63.8	64.4	67.1	55.3	-	-
12	DoT (Seri), Birbhum	62.5	62.9	66.9	53.1	-	-
13	DoT (Seri), Nadia	64.0	63.1	66.9	53.1	-	-

3.D.2.2.2. BAI (P) 010: Popularization of authorized silkworm (*Bombyx mori* L.) hybrids. (Sept., 2010 to Aug., 2012)

G. K. Chattopadhyay (PI), A. K. Saha and S. Sreekumar.

Objective: To popularize the authorized hybrids by supplying P1 dfls to NGOs, LSP and DoT (Seri) and their hybrids to the farmers of West Bengal for increasing productivity and quality silk.

A total of 2,50,269 dfls were prepared at RSRSs and RECs of the Institute, DoT (Seri), Berhampore, DoT (Seri), Malda, DoT (Seri), Coochbihar, NGO, Nabagram, Murshidabad, LSP-Malda, Society for Progressive Action in Rural Community (Field unit Sutia, Bangaon, 24 Parganas (North) and Bose Institute Experimental Farm, Falta, 24-Parganas (South). In addition, 1780 dfls of M.Con.1, 4500 dfls of M.Con.4, 835 dfls of B.Con.1 and 1035 dfls of B.Con.4 as P1 were supplied to prepare commercial hybrids, Nistari +p x M.Con.4, M.Con.1 x M.Con.4, M.Con.4 x B.Con.4 and B.Con.1 x B.Con.4 and its' reciprocal during different seasons. Besides, 5375 dfls of aforesaid hybrids were also directly supplied by the Institute to the farmers of Murshidabad and Birbhum districts of West Bengal. The



cocoon yield obtained by the farmers was 35-40 kg/ 100 dfls in Nistari +p x M.Con.4, 35- 45 kg/ 100 dfls in M. Con.1 x M. Con.4, 36-45 kg/ 100 dfls in M.Con.4 x B.Con.4 during unfavourable seasons. On the other hand, M.Con.1 x M.Con.4, M.Con.4 x B.Con.4 and B.Con.1 x B.Con.4 yielded 38-42 kg, 54- 60 kg and 52 - 64 kg cocoons per 100 dfls respectively during favourable seasons as compared to the ruling multi x multi, Nistari+p x M12 (W) which yielded 25.9 -26.6 kg/ 100 dfls and Nistari +p x NB4D2 (36-40.4 kg /100 dfls).

3.D.2.2.3. MSRAP: Mulberry Silkworm Race Authorization Prog. (Phase-VIII) (Jan., 2011 to Dec., 2012)

H. Lakshmi (upto 06.12.2012), N. Suresh Kumar and A. K. Saha

Objective: To identify region and season specific hybrids.

The prog. was conducted at 8 centres namely, RSRS, Jorhat, RSRS, Ranchi, RSRS, Koraput, RSRS, Kalimpong, Piasbari Farm, DoT (Seri), Kolitha, DoT (Seri) West Bengal, STI, Shillong, DOS Farm, Aizawl under the jurisdiction of this institute. Bivoltine hybrids: 4 centres and multi x bi hybrids: 5 centers (RSRS Koraput for both bi x bi and multi x bi hybrids).

Multi x Bi hybrid: M6DPC x SK4C stood first followed by Nistari x (SK6 x SK7).

Bi x Bi hybrid: The double hybrid (CSR50 x CSR52) x (CSR51 x CSR53) stood first followed by CSR50 x CSR51 and CSR28DR x CSR21DR.

3.D.2.3. EXTENSION & PUBLICITY DIVISION

3.D.2.3.1. BMO (P) 003: Institute Village Linkage Programme (Phase-III) (April, 2010 to March, 2013)

D. Das (PI), S. K. Mukhopadhyay, M. V. Santha Kumar, S. Chanda, C. Maji, T. K. Biswas, N. R. Rao, A. H. Naqvi, S. P. Chakraborty, A. K. Dutta, D. Pandit, A. K. Verma, S. T. Lepcha, S. P. Sharma, D. P. Dasmahapatra, B. N. Chowdhury, G. B. Singh, S. Singh, A. Barah and Z. Colin.

Objectives: To identify the problem of the target group based on analyzing the existing farming situation at the given area. To apply participatory methodologies for solving identified problems and thereby increasing productivity & profitability in a sustained manner. To impart training to the target group.

During the year 20 farmers were added to the existing 70 farmers for each of the 3 irrigated centres i.e. CSR&TI, Berhampore, REC, Mothabari (Malda) and REC, Kamnagar (Murshidabad) and a total of 270 farmers were covered. Mulberry leaf yield was recorded 40 mt/ha/yr with 12% gain over the control (35.5 mt/ha). Silkworm rearing was conducted during Baisakhi, Shravani, Bhaduri, Aswina,



Aghrayani and Falgooni crops with 31000 dfls of multi x multi, 115450 dfls of multi x bi and 100 dfls of bi x bi and the corresponding cocoon yield registered were 27 kg/100 dfls against 25 kg/100 dfls in control (Gain: 10%) for multi x multi, 42 kg/100 dfls against 38 kg/100 dfls under control (Gain: 12%) for multi x bi. In case of bi x bi (SK6 x SK7), cocoon yield was 40 kg/100 dfls which was 14% more than the control (35 kg/100 dfls). Under rainfed zone, mulberry leaf yield was 13 mt/ ha/yr against 11 mt/ha/yr in control with a gain of 19.6%. A total of 41357 dfls of bi x bi, 38172 dfls of multi x bi and 18100 dfls of multi x multi were reared and the average cocoon yield for bi x bi was 44 kg/100 dfls against 37 kg/100 dfls in control (Gain: 17%). For multi x bi the cocoon yield was 41 kg/100 dfls against 37 kg/100 dfls in control (Gain: 11%) and in multi x multi, the yield was 26 kg/100 dfls against 24 kg/100 dfls in control (Gain: 7 %).

3.D.2.4. BIOTECHNOLOGY SECTION

3.D.2.4.1. BPP (PS) 001: Improvement of mulberry through *in vitro* mutagenesis and somaclonal variation. (July, 2011 to Dec., 2012)

N. Lalitha (PI) and R. Banerjee

Objectives: To develop a regeneration protocol of mulberry genotypes S-1635 and C-2038 for deriving putative mutants by employing chemical mutagens. To develop a regeneration protocol of mulberry genotypes S-1635 and C-2038 for deriving somaclonal variants.

E01: Standardization of callogenesis and regeneration protocol in mulberry genotypes S-1635 and C-2038.

Sterilized internodal and leaf explants induced callogenesis at various combinations of growth hormones with 2-4-D, picloram, 6 BAP and NAA. Internodal explants were more responsive than leaf explants of S-1635 and C-2038 with respect to callusing. Callus induction began within 14–21 days of culture with enlargement and proliferation from the entire exposed surface of the inoculated explants.

Experiments on optimization of cytokinin and auxin ratio for prolific callus yield from internodal and leaf explants of S-1635 and C-2038 revealed that prolific callusing was obtained from the internodal explants cultured in MS media supplemented with 2-2.5mg L⁻¹ of 2-4-D (Fig 5A). Best callus induction (79%) in inter nodal explants of S-1635 was recorded on MS medium supplemented with 2.5 mg L⁻¹ of 2-4-D and 2mg L⁻¹ 6, BAP (Table- 25). However, the mulberry genotype, C-2038 showed a maximum callusing of 55% only in media supplemented with 2-4-D (2mg L⁻¹) in combination with 6 BAP (2mg L⁻¹). Explants on media with high auxin concentrations initiated calli earlier than those with lower concentrations. However, the extent of callus proliferation was limited within a range of favourable concentration of the auxin 2-4-D (2-2.5 mg L⁻¹). The callus cultures were transferred to fresh medium at 15 days interval with different PGR combinations in order to



replenish the nutrient requirements and induce organogenesis. The callus which did not respond to organogenesis or embryogenesis turned black within 8 weeks of culturing. The photographic illustrations of the callogenesis experiments were given in Plate 1A.

Effect of picloram on callusing: The supplementation of growth hormone picloram ($0.5\text{--}3\text{ mg L}^{-1}$), 6 BAP and NAA in various combinations were attempted to induce callogenesis (Fig 5B). The internodal explants of C-2038 showed maximum callusing (83%) in MS media supplemented with picloram (1.5 mg L^{-1}) followed by inter nodal explants of S-1635 (75%) with picloram (2 mg L^{-1}).

Regeneration: Subsequent to callus proliferation regeneration was attempted with different media compositions. Encouraging results for regeneration was obtained from the callus grown in the highlighted combination of PGR and further organogenesis was best achieved in $\frac{1}{2}$ MS media with 6 BAP (1.0 mg L^{-1}) and NAA (0.05 mg L^{-1}). Interestingly, induction of somatic embryogenesis was observed, when the callus cultures were transferred to $\frac{1}{2}$ MS media devoid of growth hormones and supplemented with 0.05% activated charcoal.

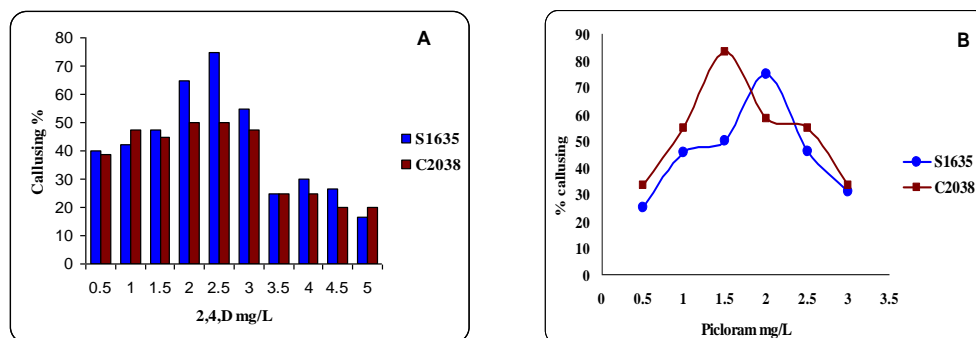


Fig. 5. Callusing percentage of internodal explants of S-1635 and C-2038 in MS media supplemented with different concentrations of (A) 2,4, D and (B) picloram

E02: *In vitro* mutagenesis of mulberry genotypes S-1635 and C-2038 using chemical mutagens.

In vitro mutagenesis has been attempted with various doses of chemical mutagens like ethyl methane sulphonate (EMS), sodium azide (NaN_3) and streptomycin sulphate (Table 25). The effect of chemical mutagens on bud breaking and shootlet formation from axillary bud explants of S-1635 and C-2038 on MS media supplemented with 2 mg L^{-1} 6 BAP were analyzed. The EMS treatment (0.2% w/v) by explant agitation method for 2h on nodal explants revealed high frequency of bud breaking and shootlet formation in both the genotypes. Bud breaking and shootlet formation were significantly delayed in EMS treated explants than the untreated control. Moreover, decrease in survival of explants with increasing concentrations and

duration of EMS was also noticed. The explants survived better with the streptomycin sulphate treatment (range: 0.2 to 1.0%) up to 24 h when compared to other mutagens and none of the selected doses were lethal at bud breaking stage. However, shootlet formation was significantly reduced by 10 to 24% in S1635 and 7.0 to 17.7% in C-2038. Sodium azide (NaN_3), at the tested concentrations range of 0.2 to 1%, for one hour duration showed lethal effects to explants of both the lines. Among the three tested chemical mutagens highest mortality was observed in NaN_3 treated explants. In both the genotypes (S-1635 and C-2038) apparently healthy *in vitro* plantlets were produced from explant agitation treatments of 0.05% EMS (2h), 0.02% of NaN_3 (1h) and 0.2% streptomycin sulphate (24h). *In vitro* rooting and further growth and regeneration (Plate 1B) was best achieved in MS basal media supplemented with 2mg L^{-1} BAP and 1mg L^{-1} NAA.

Table 25. Effect of chemical mutagens on bud breaking from axillary bud explants of S-1635 & C-2038 on MS media supplemented with 2mg L^{-1} 6-BAP

Mutagen treatment	Dose (%)	Treatment duration (h)	Bud breaking* (%)		Shootlet formation** (%)	
			S-1635	C-2038	S-1635	C-2038
EMS	0.05	2	35.29 \pm 3.47	20.56 \pm 2.42	28.89 \pm 4.44	14.87 \pm 3.57
	0.2		40.00 \pm 5.77	26.67 \pm 3.33	33.33 \pm 6.67	16.67 \pm 3.33
	0.4		36.67 \pm 3.33	16.67 \pm 3.33	23.33 \pm 3.33	10.00 \pm 0.00
	0.6		16.67 \pm 3.33	13.33 \pm 3.33	13.33 \pm 3.33	3.33 \pm 3.33
	0.8		13.33 \pm 6.67	10.00 \pm 0.00	10.00 \pm 0.00	0.00
	1.0		6.67 \pm 3.33	0.00	0.00	0.00
Streptomycin sulphate	0.2	24	56.67 \pm 6.67	43.33 \pm 3.33	40.00 \pm 5.77	33.33 \pm 6.67
	0.4		60.00 \pm 5.77	46.67 \pm 6.67	36.67 \pm 3.33	33.33 \pm 3.33
	0.6		46.67 \pm 3.33	46.67 \pm 8.82	33.33 \pm 3.33	30.00 \pm 5.77
	0.8		40.00 \pm 5.77	33.33 \pm 3.33	30.00 \pm 5.77	23.33 \pm 3.33
	1.0		33.33 \pm 3.33	26.67 \pm 3.33	16.67 \pm 3.33	13.33 \pm 3.33
NaN_3	0.05	1	20.00 \pm 0.00	26.67 \pm 3.33	13.33 \pm 3.33	16.67 \pm 3.33
	0.02	1	28.57 \pm 4.59	35.00 \pm 5.00	19.05 \pm 3.33	17.50 \pm 2.50
Control	-	-	76.67 \pm 3.33	60.00 \pm 5.77	60.00 \pm 0.00	53.33 \pm 3.33
LSD (0.05%)			7.14	7.27	6.46	5.91

Each value represents mean (\pm standard error) from 3 replicates having ten explants per replicate. * Observation taken after 15days of inoculation in respective media. ** Observation taken after 45days of inoculation in respective media.



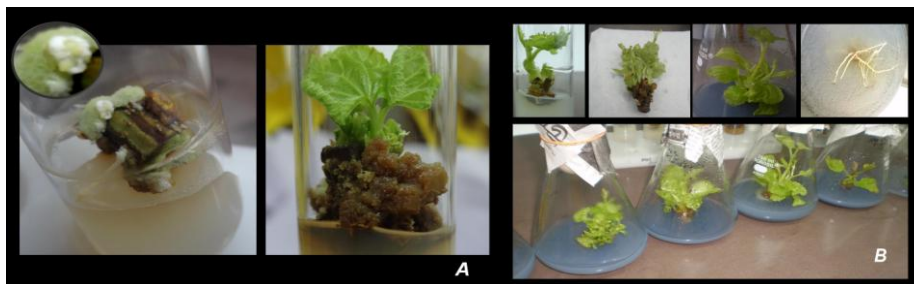


Plate -1: A) Photographic illustration of callogenesis and organogenesis. B) Standardization of dosage and treatment duration for *in vitro* mutagenesis.

3.D.3. DISEASE AND PEST MANAGEMENT:

3.D.3.1. SILWORM PATHOLOGY SECTION

3.D.3.1.1. BAR(P)013: Studies on the identification of the causal agent symptomatic of Gattine like disease in silkworm *Bombyx mori* L. (Jan., 2011 to Dec., 2012)

Z. Hossain (PI), S. Chakrabarty and A. K. Saha.

Objective: Identification of virus of Gattine like disease infecting silkworm *B. mori*.

Attempt using two protocols were made to isolate and purify the virus from the Vth stage diseased larval samples of silkworms collected from farmers' field and also from the rearings conducted in the institute as well. The modified protocol of Himeno *et al.*, 1979 using Ammonium sulphate as the virus precipitant was attempted. After partial purification of the diseased samples in this Institute, they were subjected to Sucrose Density Gradient Ultra Centrifugation for final purification at Indian Institute of Chemical Biology, Kolkata. A second protocol of Sivaprasad *et al.*, 2003 using PEG 6000 as the virus precipitant was also employed for isolation of the virus. In spite of using the two protocols, as stated above, no virus was detected in the samples undertaken for the study. Hence, the study needs to be repeated with a separate/modified protocol to ascertain presence of virus.

3.D.3.1.2. BAR (VP) 005: Study on the efficacy of newly developed bed disinfectant (Sericillin) in hot spot areas for the control of muscardine disease of silkworm, *Bombyx mori*. (Aug., 2010 – July, 2012)

S. Chakrabarty (PI), Z. Hossain, A. K. Saha, A. K. Dutta (REC, Mothabari), A. K. Verma (Sub-REC, Rajmahal), S. P. Chakrabarty (REC, Kamnagar), B. Rana (REC, Imphal) and K. B. Chauhan (REC, Singhanpur).

Objectives: To study the incidence of Muscardine disease of silkworm, *Bombyx mori* L. in hot spot areas. To study the efficacy of newly developed bed disinfectant (*Sericillin*) in hot spot areas for the control of muscardine disease of silkworm, *Bombyx mori* L. as well as yield gain over control.

Sericillin was tested at 1401 farmers with 2.8 lakh dfls. During August, 2010- March, 2011, incidence of muscardine was reported 1.4% against 2.2% in control while 4.2 % muscardine was reported against 11.2 % in unprotected condition in 25 farmers' houses of three villages under Sub-REC, Rajmahal during Aghrayani, 2010. Average cocoon yield gain over control was 4.3 kg (10%) / 100 dfls using the sericillin by 305 farmers (30500 dfls) at hot spot areas for control of muscardine disease. During April, 2011- March, 2012, average Muscardine incidence was 1.4% against 2.4 % in control. The cocoon yield gain over control was 4.7 kg (12.5%) per 100 dfls. During April, 2012- July, 2013, Muscardine incidence reported 0.01% against 20% control during Baisakhi, 2012. The cocoon yield gain over control was 3 kg (13.8%)/ 100 dfls using the 'Sericillin' by 24 farmers brushed on 5000 dfls. With the use of 'Sericillin' all the common silkworm diseases, especially muscardine can be prevented effectively, thereby improving the cocoon production of 3-4.2 kg cocoons /100 dfls (11-13 % more than the control). The formulation is cost-effective (Benefit cost ratio is 6.4: 1) and all the chemicals required for preparation of 'Sericillin' is easily available in the local market.

3.D.3.1.3. BAR (RP) 005: Survey and surveillance of silkworm diseases in traditional Sericultural districts of West Bengal. (April, 2011 to March, 2013) (Routine activity)

S. Chakrabarty (PI), A. K. Dutta (REC, Mothabari), A. K. Verma (Sub-REC, Rajmahal), D. Pandit (REC, M P Raj), S. P. Chakrabarti (REC, Kamnagar), I/C, REC, Bademarenga and REC, Deogarh.

Objectives: To suggest 'on spot' effective remedial measures to the farmers to control the disease and forewarn the farmers for ensuing commercial crop in West Bengal. To prepare database on the incidence of various diseases of silkworm, *B. mori* during commercial crops in the traditional sericultural districts of West Bengal.

Crop wise survey of silkworm diseases was conducted at 214 farmers' of 48 villages in three districts, Murshidabad, Malda and Birbhum in West Bengal. Incidence of grasserie was reported 2-5% during Baisakhi (March-April), up to 7% in Aswina (August – Sept.) and 11-13% in Falgooni (February) crops. In Murshidabad (Balaspur area), maximum crop loss of 14% and 42% was reported due to incidence of muscardine disease during Baisakhi and Falguni commercial crop, 2013 respectively. Gattine disease was reported 16.2 % during Baisakhi and Grasserie of 11% during Falguni crop season. In Birbhum, high incidence (13.2%) of Grasserie was recorded during Falguni crop while, high incidence of muscardine (20.2 %) and Gattine (20.3%)



was recorded during Baisakhi crop season. In Malda, incidence of Gattine was high (13%) during Baisakhi, Flacherie (16.6%) and Muscardine (23.3 %) during Falguni crop season was recorded.

3.D.3.2. RSRS, JORHAT

3.D.3.2.1. B-JRH (P)-011: Studies on the biology and feeding efficiency of the coccinellid predator, *Scymnus* sp. for management of whitefly on mulberry. (April, 2011 to March, 2013)

Y. Debaraj (PI) and S. N. Gogoi.

Objective: To study the biology and feeding efficiency of the coccinellid predator, *Scymnus posticalis*.

Studies on biology of the predator revealed that egg hatched in 4.9 days and larval development (1 - 4 instars) was completed in 13.7 days. The pre-pupa and pupa took 2.1 days and 7.3 days respectively. The life cycle (egg to adult) of the predator feeding on mealy bug eggs and nymphs was completed in 28 days. The duration of development and measurement of different stages of the predator are depicted in (Table 26). The copulation and oviposition period of the predator took 6.8 min. and 23.4 days. The fecundity of a female on average was 15.5 eggs. The longevity of male and female adults was 27 and 32 days. The data on the biological attributes of *Scymnus posticalis* are presented in the (Table 27). The feeding efficiency studies of the predator on whitefly eggs and nymphs revealed that a predator grub consumed 487 eggs or 163 nymphs of whitefly. An adult male predator consumed 986 eggs or 335 nymphs and a female consumed 1210 eggs or 424 nymphs of whitefly.

Table 26. Developmental period and sizes of life stages of *Scymnus posticalis* (Mean \pm SD)

Life stages	Developmental period	Measurement (mm)	
		Length	Breadth
Egg	4.93 \pm 0.75	0.38 \pm 0.03	0.20 \pm 0.024
I – instar	2.56 \pm 0.44	0.53 \pm 0.05	0.17 \pm 0.017
II – instar	2.86 \pm 0.65	1.57 \pm 0.19	0.76 \pm 0.07
III – instar	3.73 \pm 0.70	2.54 \pm 0.19	1.27 \pm 0.05
IV – instar	4.58 \pm 0.46	3.49 \pm 0.26	1.60 \pm 0.19
Pre – pupa	2.08 \pm 0.60	3.38 \pm 0.36	1.58 \pm 0.19
Pupa	7.30 \pm 0.77	3.53 \pm 0.35	2.10 \pm 0.22
Male Adult	27.71 \pm 2.87	1.88 \pm 0.06	1.16 \pm 0.03
Female	32.57 \pm 3.10	2.56 \pm 0.05	1.24 \pm 0.03



Table 27. Biological attributes of *Scymnus posticalis* Sicard

Life cycle stages	Duration of development
Egg	4.9 days
Larvae (I – IV instar)	13.7 days
Pre – pupa	2.1 days
Pupa	7.3 days
Egg to Adult	28.0 days
Copulation period	6.8 min
Ovi-position period	23.4 days
Fecundity	15.5 eggs

3.D.4. COST REDUCTION

3.D.4.1. AGRONOMY SECTION

3.D.4.1.1. BPP(P)012: Studies on reduction in cost of production and improvement on crop productivity for sustainable sericulture under West Bengal conditions. (Sept., 11 to Feb., 13)

S. Rajaram (PI) and S.K. Mandal

Objective: To bring improvement in utilization of man power and natural resources in mulberry cultivation through use of simple cost-effective tools, devices and machines. To remove drudgery and facilitate completion of work in time. To reduce man power requirement and cost of production. To bring improvement on quality linked crop productivity in mulberry. To increase income at farmers' level for sustainable sericulture in West Bengal.

Successfully developed an E³ WM© LM (simple E³ WM cum LM (simple Efficient Economic Eco-friendly Weed Mower cum Lawn Mower) under the concluded exploratory innovative study. Efficiency Index of 20 recorded for the E³ WM© LM (simple E³ WM cum LM (simple Efficient Economic Eco-friendly Weed Mower cum Lawn Mower) on validation. HRUE index commensurate with the power and efficient functioning of the machine was recorded as 20 on validation and hence it is undoubtedly.



3.D.4.1.2. RSRS, KALIMPONG

3.E.1.1. B-KPG (P) 016: Assessment of fertility status of RSRS farm and progressive farmers' fields in selected Seri villages of Kalimpong to increase the yield and quality of mulberry (*Morus spp*) leaves. (Oct., 2011 to Dec., 2012)

R. L. Ram (PI)

Objectives: To study the fertility status of soils of RSRS farm and progressive farmers' fields in selected Seri villages of Kalimpong. To calculate the doses of lime requirement of soils of RSRS farm and progressive farmers' fields in selected Seri villages of Kalimpong. To separate the clay particles of RSRS farm soils for X-ray diffraction analysis of clay mineralogy. To classify the farm soils of RSRS, Kalimpong.

E01: To study the fertility status of soils of RSRS farm and progressive farmers' fields in selected Seri villages of Kalimpong.

Morphological properties and textural class of Kalimpong soils:

At RSRS farms and farmers' field of Kalimpong hills, soils of mulberry plantations studied were shallow to very deep in depth; dark yellowish brown (10 YR 4/4) to brown (10 YR 5/4 and 6/4) in colour; sandy loam to sandy clay loam texture; single grain to fine, medium, subangular blocky structure; dry semi hard, moist very friable to friable, wet slightly sticky to sticky and wet slightly plastic consistency; very fine to fine, few to many pores and clear to gradual smooth and wavy horizon boundary. Light texture, poor soil structure and low consistency is due to sandstone parent materials because, the nature and properties of soil is varied with parents materials.

2. Chemical properties and nutrients status of soils of farms and farmers' field:

Based on 191 soil samples analyzed, soils of RSRS farms and farmers fields are slight to strong acidic in nature, medium to high organic carbon and nitrogen content available whereas phosphorus and sulphur content is low to medium. The pH of all the soils ranged from 5.0 to 6.5 and EC from 0.1 to 0.2 dSm⁻¹ respectively. Likewise, the organic carbon, available nitrogen, phosphorus, potash and sulphur mean in soils of RSRS farms and farmers' fields ranged from 0.8-1.9% (OC); 432.8-668.6 kg ha⁻¹ (N); 14.4-23.5 kg ha⁻¹ (P); 164.7-372.4 kg ha⁻¹ (K) and 9.6-15.4 kg ha⁻¹ (S) respectively.

E02: To calculate the doses of lime requirement of soils of RSRS farm and progressive farmers' fields in selected Seri villages of Kalimpong.

Based on base saturation method for lime requirements, RSRS, Kalimpong soil require 1.5 mt ha⁻¹ and RSRS Annexure, Kalimpong 2.3 mt ha⁻¹ respectively. The



lime (calcite) requires for farmers' field varied according the exchangeable bases which ranged from 0.6- 1.5 mt ha⁻¹.

E03: To classify the farm soils of RSRS, Kalimpong.

Based on morphological, physical and chemical properties, soil temperature and soil moisture regime, the soils of RSRS farms and farmers fields has been classified into Coarse loamy, mixed, Thermic, Typic Udarthents and Coarse loamy, Mixed, Thermic, Typic Hapludepts respectively.

Conclusion: The soils of RSRS farms and farmers' field of Kalimpong hills are shallow to very deep in depth, light coloured, light textured, poor structure and consistency etc. Based on 191 soil samples analyzed, soils of RSRS farms and farmers fields are slight to strong acidic in nature, medium to high organic carbon and available nitrogen content whereas low to medium phosphorus, potash and sulphur content. Based on base saturation method for lime requirements, RSRS, Kalimpong soil require 1.5 mt ha⁻¹ calcite and RSRS Annexure, Kalimpong 2.3 mt ha⁻¹ calcite respectively. The lime (calcite) requires for farmers' field varied according the exchangeable bases which ranged from 0.6- 1.5 mt ha⁻¹. Soils of RSRS farms and farmers fields has been classified into Coarse loamy, mixed, Thermic, Typic Udarthents and Coarse loamy, Mixed, Thermic, Typic Hapludepts, respectively.

Table 28. Exchangeable bases and lime requirements of soils of farms and farmers' field

Sl. No.	Location	Exchangeable bases mean[cmol (p+)kg-1]						ESP (%)	BS (%)	Lime (Calcite) requirements at 60% BS (mt ha ⁻¹)*
		Ca	Mg	Na	K	Sum	CEC			
1	RSRS Farm	3.6	2.1	1.3	0.5	7.5	13.6	9.3	54.8	1.5
2	RSRS Annex Farm	1.7	0.9	0.7	0.4	3.7	8.0	9.2	46.6	2.3
3	Kharka Busty	4.0	2.8	1.8	0.5	9.0	15.4	11.6	58.3	0.6
4	Balukhap	3.1	2.5	1.8	0.5	7.9	13.6	13.2	58.2	0.6
5	Mahakaldara	2.6	0.8	1.3	0.7	5.4	10.0	13.0	53.5	1.4
6	Khani	2.5	1.0	0.9	0.6	4.9	9.2	9.3	53.1	1.4
7	Gitdabbling	3.4	1.5	1.3	0.6	6.7	12.2	10.1	55.1	1.3
8	Saurani	2.1	1.7	1.2	0.8	5.7	10.6	11.3	54.0	1.5
9	Dolapchand	2.5	1.9	1.3	0.7	6.3	11.4	11.0	55.0	1.3
10	Sangsay	3.3	2.0	1.4	0.5	7.1	12.9	11.0	55.1	1.4

* Lime requirements method based on Base saturation of soil.



4. TRANSFER OF TECHNOLOGY

4.1. EXTENSION ACTIVITIES OF RSRs AND RECs

4.1.1. REGIONAL SERICULTURAL RESEARCH STATIONS

4.1.1.A. RSRs, KALIMPONG

- ❖ **Testing of new mulberry variety TR-23:** A total of 140 kg mulberry cuttings were supplied to the rearers of 2 villages of Kalimpong (Mahakaldara and Kharkabusty). Plantation is in the establishment stage.
- ❖ **Bivoltine seed cocoon generation programme:** A total of 50 dfls of SK6 and SK7 were reared and the cocoons were utilized for production of bivoltine dfls. Besides, 1500 dfls of SK6 x SK7 were supplied to DoS, Ambikapur, Chhattisgarh during August, 2012 and 5500 dfls to REC, Agartala during October, 2012.

4.1.1.B. RSRs, KORAPUT

- ❖ **Bivoltine seed cocoon generation programme:** A total of 100 dfls of SK6 x SK7 were reared and cocoon yield was 47.7 kg.
- ❖ **Post-Authorization Trial (PAT):** Rearing was conducted at farmers' field with 1800 dfls of M. Con4 x B. Con4 - 1800 dfls and 200 dfls of N x NB4D2. Cocoon samples were sent to SCTH Malda for analysis.

4.1.1.C. RSRs, RANCHI

- ❖ **Testing of new mulberry variety S-1635:** Mulberry leaf yield was 10.3 mt/ ha/ yr against the control yield of 8.8 mt/ha/yr with 16% yield gain.
- ❖ **Bivoltine seed cocoon generation programme:** A total of 25 dfls of SK6 x SK7 were reared and the cocoon yield recorded was 34.4 kg/100 dfls.
- ❖ **Testing of new silkworm hybrids:** A total of 90 dfls of seven multi x bi hybrids were tested.

4.1.1.D. RSRs, JORHAT

- ❖ **Testing of new silkworm hybrids:** Three multi x bi silkworm hybrids, M6DPC x D6PN, M6DPC x (D6PN x SK4C) and N x NB4D2 were reared during spring and autumn and the cocoon yield was 35.8 kg, 34.4 kg and 36.9 kg/100 dfls respectively. Two bivoltine hybrids, D6PN x SK4C and NB18 x P5 reared and the cocoon yield obtained 35.2 kg/ 100 dfls and 32.9 kg/100 dfls respectively.
- ❖ **Post-Authorization Trial (PAT):** A total of 2500 dfls were reared by the farmers.



4.1.2. RESEARCH EXTENSION CENTRES (RECs)

1. REC, AGARTALA

- ☞ **Bivoltine seed cocoon generation programme:** A total of 155 dfls of SK6 x SK7 were reared and the cocoon yield was 45.4 kg/100 dfls.
- ☞ **Post-Authorization Trial (PAT):** A total of 1500 dfls of Gen2 x Gen3, SLD4 x SLD8 and NB18 x P5 were reared at farmers level.

2. REC, AIZAWL

- ☞ **Bivoltine seed cocoon generation prog.:** A total of 1000 dfls of SK6 x SK7 were reared and the cocoon yield was 47.8 kg/100 dfls.
- ☞ **Testing of new silkworm hybrids:** Three multi x bi silkworm hybrids, M6DPC x D6PN, M6DPC x (D6PN x SK4C) and N x NB4D2 were reared during spring and autumn. The cocoon yield recorded was 49.7 kg, 52.5 kg and 50.3 kg/100 dfls respectively. Two bivoltine hybrids, D6PN x SK4C and NB18 x P5 reared and the cocoon yield was 54.8 kg and 49 kg/100 dfls respectively.
- ☞ **Post-Authorization Trial (PAT):** A total of 7000 dfls of Gen2 x Gen3, SLD4 x SLD8 and NB18 x P5 were reared and cocoon yield was 48.4 kg/100 dfls.

3. REC, IMPHAL

- ☞ **Bivoltine seed cocoon generation prog.:** A total of 100 dfls of SK6 x SK7 was reared at the farm and the cocoon yield recorded was 50 kg/100 dfls.
- ☞ **Testing of new silkworm hybrids:** Three multi x bi silkworm hybrids, M6DPC x D6PN, M6DPC x (D6PN x SK4C) and N x NB4D2 were reared during spring and the yield recorded was 53.3 kg, 54 kg and 46.7 kg/100 dfls respectively. Two bivoltine hybrids, [D6PN x SK4C and NB18 x P5 were also reared and the yield was 26.7 kg and 30 kg/100 dfls respectively.
- ☞ **Post-Authorization Trial (PAT):** A total of 2500 dfls of Gen2 x Gen3, SLD4 x SLD8 and NB18 x P5 were reared.

4. REC, DIMAPUR

- ☞ **Bivoltine seed cocoon generation prog.:** A total of 200 dfls of SK6 x SK7 were reared.
- ☞ **Post-Authorization Trial (PAT):** A total of 300 dfls of Gen2 x Gen3, SLD4 x SLD8 & NB18 x P5 were reared at farmers' level.

5. REC, SHILLONG

- ☞ **Bivoltine seed cocoon generation prog.:** A total of 100 dfls of SK6 x SK7 was reared and the cocoon yield recorded was 43.6 kg/100 dfls.



- ☞ **Testing of new silkworm hybrids:** Three multi x bi silkworm hybrids, M6DPC x D6PN, M6DPC x (D6PN x SK4C) and N x NB4D2 were reared during spring and autumn seasons the cocoon yield was 46 kg, 48 kg and 43 kg/100 dfls respectively. Two bivoltine hybrids, D6PN x SK4C and NB18 x P5 were also reared and the yield obtained was 51 kg and 46 kg/100 dfls respectively.

6. REC, RANGPO

- ☞ Under the Beneficiary Empowerment Programme of CDP, a total of twenty one training programmes were conducted in different locations during May, July, Sept. and Nov., 2012 and 461 farmers were trained on mulberry cultivation including nursery raising, bivoltine rearing, chawki rearing and vanya silkworm food plants.
- ☞ Exposure visit of five days for 27 farmers were made to Regional Office, Guwhati, Khanapara DoS farms, RMRS Boko and adjoining muga and eri-certified villages in South Kamrup, Assam.

7. REC, MAHESHPUR RAJ:

- ☞ **Testing of new silkworm hybrids :** Four multi x bi silkworm hybrids, M6DPC x D6PN, M6DPC x (D6PN x SK4C), MH1 x C. niche and N x NB4D2 were reared during Baisakhi, Aswina and Agrahayani crops, the yield was recorded as 45.3kg, 49.5 kg, 49.2 and 39.4 kg/100 dfls respectively.
- ☞ **Post-Authorization Trial (PAT):** In two crops, three multi x bi hybrids M.Con.1 x B.Con.4 -2400 dfls, M.Con.4 x B. Con. 4 – 2600 dfls, N x NB4D2 -3500 dfls were reared and the yield obtained was 49 kg, 52 kg and 41 kg/ 100 dfls respectively.

8. REC, MOTHABARI

- ☞ **Promotion of bivoltine rearing:** A total of 500 dfls of SK6 x SK7 were reared by 5 farmers in 2 crops and the cocoon yield recorded was 62.3 kg/100 dfls.
- ☞ **Post-Authorization Trial (PAT):** In Agrahayani crop, 10,000 dfls of three multi x bi hybrids, M.Con.1 x B. Con. 4 -3000 dfls, M.Con.4 x B.Con. 4 - 5000 dfls and N x NB4D2-2000 dfls were reared and the yield obtained was 49.8 kg, 53 kg and 45 kg/ 100 dfls respectively. In Falgooni crop, three multi x bi hybrids, M.Con. 1 x B. Con4 -6000 dfls, M. Con. 4 x B. Con. 4-3000 dfls and N x NB4D2 -2000 dfls were reared and the cocoon yield obtained was 50 kg, 55 kg and 45.5 kg/ 100 dfls, respectively. In bi x bi, Gen 2 x Gen 3- 5000 dfls and NB 18 x P5- 500 dfls were reared and the cocoon yield obtained was 63 kg and 60.3 kg/100 dfls respectively.



9. REC, KAMNAGAR

- ☞ **Post-Authorization Trial (PAT):** In Agrahayani crop, three multi x bi hybrids, M. Con.1 x B. Con. 4 -3000 dfls, M. Con.4 x B. Con. 4 - 5000 dfls and N x NB4D2-2000 dfls were reared and the yield obtained was 53 kg, 55 kg and 46 kg/ 100 dfls, respectively. In Falgooni crop, multi x bi hybrids, M. Con.1 x B. Con. 4 -6000 dfls, M. Con.4 x B. Con. 4 – 2000 dfls and N x NB4D2 -2000 dfls were reared and the cocoon yield obtained was 59 kg, 64 kg and 47 kg/ 100 dfls respectively and two bi x bi hybrids, Gen3 x Gen2-1000 dfls, NB18 x P5-500 dfls were reared and the cocoon yield obtained was 71 kg, and 68 kg/ 100 dfls respectively.
- ☞ **Testing of new silkworm hybrids:** Three multi x bi hybrids, M6DPC x D6PN, [M6DPC x (D6PN x SK4C)] and N x NB4D2 were reared and the yield recorded was 50.6 kg, 52.8 kg and 46.7 kg/100 dfls respectively. Also, two multi x multi hybrids, MH1 x C. nichii and N x M12W were tested and the yield recorded was 35.5 kg and 28.4 kg/100 dfls respectively.

10. REC, DEORAGH

- ☞ **Testing of new silkworm hybrids:** Two bi x bi hybrids, D6PN x SK4C and NB18 x P5 were reared and the cocoon yield was 51 kg and 44 kg/100 dfls respectively.
- ☞ **Post-Authorization Trial (PAT):** During spring crop, three multi x bi hybrids M.Con.1 x B.Con. 4 -1800 dfls, and N x NB4D2 -200 dfls were reared and the cocoon yield obtained was 35.4 kg and 32.9 kg /100 dfls respectively.

11. REC, BADEMARANGA

- ☞ **Bivoltine seed cocoon generation programme:** A total of 100 dfls of SK6 x SK7 were reared and the cocoon yield was 40 kg/100 dfls.
- ☞ **Studies on the efficacy of bed disinfectant Sericillin:** A total of 12000 dfls were tested by 10 farmers in 4 crops and the cocoon yield was 48 kg/100 dfls against the control yield of 44 kg with 9.3% gain over the control.

12. REC, GUMLA

- ☞ **Bivoltine seed cocoon generation programme:** A total of 800 dfls of SK6 x SK7 were reared at the farmers' level and the cocoon yield was 30 kg/100 dfls.
- ☞ **Post-Authorization Trial (PAT):** Two multi x bi hybrids, 2250 dfls of M. Con. 4 x B.Con.4 and 100 dfls of N x NB4D2 were reared at the farmers level.



13. SUB- REC, RAJMAHAL

- ☞ **Bivoltine seed cocoon generation programme:** A total of 50 dfls of SK6 x SK7 were reared at farm level and the cocoon yield was 41 kg/100 dfls.
- ☞ **Post-Authorization Trial (PAT):** Three multi x bi hybrids and two bi x bi hybrids, 3000 dfls of M. Con.1 x B. Con.4, 4000 dfls of M. Con.4 x B. Con.4 and 5000 dfls of N x NB4D2 were reared during autumn crop and the cocoon yield obtained was 59 kg, 61 kg and 43 kg/100 dfls respectively. In bi x bi, 400 dfls of Gen2 x Gen3 and 200 dfls of NB18 x P 5 were reared during spring crop and the cocoon yield was 90 kg and 62 kg/100 dfls respectively.

14. SUB-REC, BHANDRA

- ☞ **Bivoltine seed cocoon generation programme:** A total of 400 dfls of SK6 x SK7 were reared at farmers' level.
- ☞ **Raising of HYV saplings:** A total of 5000 saplings each of S-1635 and S-1 were raised for supply to the farmers.

OTHER ACTIVITIES

Table 29 A. Programme under CPP and CDP

Sl. No.	Name of the centres	Awareness Prog. (Participants)	Farmers training. (Participants)	Exposure visit (Participants)
1.	RSRS, Jorhat	-	3(76)	-
2.	REC, Mothabari	1(83)	3(160)	7(250)
3.	REC, Rangpo	-	21(461)	1(27)
4.	REC, Aizawl	-	2(100)	6(192)

Table 29 B. Farmers' Trained through FFS

Name of the centre	Trained under FFS	Name of the centres	Trained under FFS
CSR&TI	267	Bademaranga	228
Ranchi	240	Deogarh	262
Jorhat	47	Rangpo	92
Kalimpong	103	Aizwal	70
Koraput	153	Imphal	80
Mothabari	621	Dimapur	65
Kamnagar	61	Shillong	127
Rajmahal	686	Agartala	47
M.P.Raj	378	Gumla	83



Table 29 C. Supply of cuttings/ saplings and farm rearing

Centres	Supply of mulberry		Farm/Farmers' Rearing		Revenue earned (Rs.)
	Saplings (Nos)	Cuttings (mt)	Dfls. reared (No.)	Cocoon yield (kg)	
RSRSs					
Kalimpong	10000		50	-	24750
Koraput	10000		100	47.0	2866
Ranchi	-	4.6	25	8.6	1676
Jorhat	-	-	100	21.5	19261
RECs					
Mothabari	-	3.8	500	311.4	33986
Kamnagar	31,200	-	-	-	46800
Rangpo	-	-	-	-	-
Deogarh	-	-	-	-	-
Bademaranga	-	-	50	20.0	6828
M.P.Raj			-	-	-
Gumla	5000		800	380.0	22012
Aizawl	-	-	1000	478.0	10000
Agartala	-	-	155	71.2	16790
Shillong	-	-	100	46.7	10770
Imphal	-	-	100	50.0	12700
Dimapur	-	-	200	49.5	9900
REC (Sub units)					
Rajmahal	5000	0.83	50	20.50	7593
Bhandra	10000	-	-	-	14213
Total:	71200	9.23	3230	1504.5	281034



Table 29 D. Extension Communication Programe, HRD and Expansion of improved mulberry varieties by different Units under CSR&TI, Berhampore

Name of the unit	Extension Communication Prog.					HRD TTP / FTP	New mulberry area increased with HYV		
	Resham Krishi Mela	Aware-ness Prog.	Field day	Exhibition	A.V. Prog.		Farmers (Nos)	Area (ha)	Variety
CSRTI, Berhampore	1 (275)	9 (402)	1 (25)	4 (1388)	1 (56)	--	7	2.75	S-1635
RSRS, Koraput	1 (205)	4 (177)	3 (176)	3 (176)	3 (176)	4 (50)	5	2.5	S-1635
RSRS, Ranchi	1 (120)	3 (110)	3 (85)	3 (150)	2 (75)	3 (10)	5	2.5	S-1635
RSRS, Kalimpong	1 (100)	6 (189)	2 (78)	2 (334)	2 (56)	2 (36)	8	2.5	BC259, TR-23
RSRS, Jorhat	1 (210)	3 (167)	2 (135)	3 (900)	3 (185)	3 (37)	12	2.5	S-1635
REC, Mothabari	-	5 (332)	5 (271)	4 (172)	5 (341)	5 (136)	20	4.2	S-1635
REC, Kamnagar	-	6 (261)	5 (201)	5 (253)	6 (216)	6 (259)	22	4.01	S-1635
REC, M.P.Raj	-	44 (197)	4 (295)	4 (295)	4 (196)	3 (167)	11	3.0	S-1635
REC(SU), Rajmahal	-	5 (322)	6 (366)	4 (248)	6 (366)	5 (327)	15	6.12	S-1635
REC, Gumla	-	3 (119)	3 (141)	3 (130)	3 (137)	5 (237)	5	2.5	S-1635
REC, Deogarh	-	3 (149)	3 (178)	3 (178)	3 (78)	5 (185)	5	2.5	S-1635
REC, Badamaranga	-	3 (90)	3 (155)	3 (155)	3 (155)	5 (150)	5	2.5	S-1635
REC, Rangpo	-	3 (85)	3 (89)	3 (184)	3 (86)	5 (175)	5	2.5	BC259, Kosen
REC, Aizwal	-	3 (193)	3 (240)	3 (193)	3 (240)	3 (127)	5	2.5	S-1635
REC, Agartala	-	3 (700)	3 (89)	3 (620)	3 (101)	3 (92)	5	2.5	S-1635
REC, Shillong	-	4 (189)	2 (92)	3 (128)	2 (86)	3 (154)	5	2.5	S-1635
REC, Imphal	-	4 (136)	4 (155)	3 (145)	3 (112)	3 (113)	5	2.5	S-1635
REC, Dimapur	-	3 (82)	3 (61)	3 (61)	3 (82)	3 (50)	5	2.5	S-1635
REC(SU), Bhandra	-	-	-	-	-	-	5	2.5	S-1635
Through Kishan Nursery	-	-	-	-	-	-	28	11.62	S-1635



5. HUMAN RESOURCE DEVELOPMENT (TRAINING COURSES)

5. A. STRUCTURED TRAINING COURSE

5.A.1. Post Graduate Diploma in Sericulture (Mulberry):

Duration: 15 months

N. K. Saha (upto 10.07.2012) and L.M. Saha (from 11.07.2012)

Objective: Development of technical personnel from the fresh/ deputed by different State Governments, NGOs to meet the requirement of sericulture industry.

A batch of 20 candidates of the session 2011-12 successfully completed PGDS course by 30th Sept., 2012 and the next batch comprising 27 candidates (Session 2012-13) are undergoing training. The course is affiliated to the University of Kalyani.

Details of Structured training course conducted

Sl. No.	Sponsoring agencies	No. of candidates	
		Completed the course by 30 th Sept., 2012	Started the course from July, 2012
1.	Govt. of Manipur	5	10
2.	Govt. of Meghalaya	8	7
3.	Govt. of Nagaland	6	3
4.	Govt. of Jammu & Kashmir	1	--
5.	Govt of Sikkim	--	5
6.	West Bengal (Direct)	--	1
7.	Madhya Pradesh (Direct)	--	1
Total		20	27

5.B. NON- STRUCTURED TRAINING COURSE

5.B.1. MDP/ SUP Training Prog.:

Duration: 5 - 10 days

R.K. Saha

Objectives: To orient and skill updating the knowledge of scientists/officers/officials of CSB/DOS with reference to need-based technologies recently developed by this research institute for its effective translation in the field of their respective states for promotion of enterprise to achieve the target. To impart practical training to the lead farmers about application of sericulture techniques in their enterprise.



With this very specific objective Management Development Programme (MDP) for officers/Scientists/technical staff of CSB and DOS and Skill Updating Programme (SUP) for farmers was initiated under Central Sector Scheme (Training Initiative, code 2109). A total of 179 and 270 candidates have undergone training under MDP and SUP in different disciplines as appended below:

Details of MDP courses conducted

Name of the course	Duration (Days)	Persons trained (Nos)			
		CSB	DOS	NGO	Total
Orientation Training Prog. “On rearing technology, Vermicompost, compost and green manure preparation” for officers of DOS/CSB	6	5	16	--	21
Total		5	16	-	21

Details of SUP courses conducted

Name of the course	Duration (Days)	Persons trained (Nos)			
		CSB	DoS	NGO	Total
Mulberry varieties and cultivation technique	05	--	23	--	23
Chawki rearing techniques	10	--	09	--	09
Late age rearing, shoot feeding, moulting care and mounting	10	--	15	--	15
Integrated disease and pest management components and concepts	06	--	25	--	25
Integrated Nutrient management components and concepts	06	--	24	--	24
Total		--	96	--	96

5.C. Integrated skill development scheme (ISDS):

Duration: Nov, 2011 to Oct., 2016

Scientist associated: Dr. (Mrs) Jalaja S. Kumar, Dr. G. K. Chattapadhy Sci-C (up to 10.07.2012) and Dr. L.M. Saha, Sci.-C (from 11.07.2012)

In view of the urgent need to upgrade the skills of textile workers and to develop competitiveness in the textile industry, the Ministry of Textiles, Govt. of India has launched Integrated Skill Development Scheme (ISDS) wherein Central Silk Board has been included as an implementing agency. At this Institute, the ISDS envisages to train youth/ women in the fields of mulberry cultivation, commercial silkworm rearing, cocoon handicrafts, silk reeling & spinning and skill updating of extension agents. The trainees will be identified and selected through interview in consultation with the local government bodies. The programme was conducted in free of cost and



accordingly all the selected candidates were provided free boarding and lodging. They were also paid their actual travel expenses and wage compensation during training period. The duration of the training period was 15 days.

Objectives: To train and motivate rural/semi-urban youth/women for developing employable skill in them to start sericulture based enterprise. To empower the rural youth/women with entrepreneurial and management skill. To address the shortage of trained manpower and to tap the huge employment potential.

Details of ISDS courses conducted

Sl. No.	Name of the course	Duration (Days)	Sponsoring authority	Persons trained
1	Skill updating of Extn. Agents	15	Through interview in consultation with the local government bodies.	15
2	Cocoon handicraft	15		15
3	Mulberry cultivation	15		15
4	Commercial silkworm rearing	15		18
		Total		63

5.D. AD-HOC TRAINING PROGRAMMES CONDUCTED ON THE REQUEST OF DIFFERENT AGENCIES

Jalaja S. Kumar, G. K. Chattapadhy (upto 10.07.2012), L.M. Saha (from 11.07.2012) and R. N. Dutta

Details of Ad-hoc traing programme conducted

Sl. No.	Course	Duration (Days)	Sponsoring authority	Persons trained
1	On job training	2 weeks	Principal, Dinabandhu Andrews college, Gorla, Kolkata	09 (B. Sc. students)
2	Silkworm rearing	5 days	ATMA, Supaul, Bihar	23 (Farmers)

5.E. VISIT OF STUDENTS FROM UNIVERSITIES/ COLLEGES/ SCHOOLS / ORGANIZATIONS AND FARMERS FOR AN EXPOSURE TO MULBERRY SERICULTURE

A total of 544 students and 235 farmers along with escorts were exposed to sericulture activities during 2012-13 at this Institute to acquire knowledge on latest technologies developed by this Institute.



VISIT OF STUDENTS AND TEACHERS/ ESCORTS

Sl. No.	Date	Sponsored by	Persons (Nos)
1	08.05.12	CTR&TI, Ranchi.	12
2	07.08.12	The God Shepherd Mission School, Barisha, Kolkata, WB.	54
3	06.10.12	The Shikhayatan School, Lord Sinha Road, Kolkata, WB.	47
4	12.10.12	Barasat Govt. College, Barasat, North Kolkata, WB.	11
5	01.11.12	G.D.Birla Centre for Education & Mahadevi Birla Sisuvihar, Kolkata.	28
6	02.11.12	Ashok Halls Girls Higher Secondary School, Kolkata, West Bengal.	22
7	02.11.12	Mahadevi Birla Sisuvihar, Kolkata, West Bengal.	07
8	14.12.12	Surendra Nath College, Dept. of Zoology, Kol.-09, WB.	64
9	27.12.12	Makhla Devi Vidyaniketan for girls, Uttarpara, Hoogly, WB.	34
10	16.02.13	Kendriya Vidyalaya, Berhampore, West Bengal.	114
11	11.03.13	K.N.College, Berhampore, Murshidabad, West Bengal.	72
12	13.03.13	K.N.College, Berhampore, Murshidabad, West Bengal.	41
13	30.03.13	The Cathedral Bidya School, Lonavala, Pune.	38
Total			544

DETAILS OF VISIT OF FARMERS WITH ESCORTS

Sl. No.	Date	Sponsored by	Persons (Nos)
1	02.07.12	Office of the Asstt. Director of Seri, Keonjhar, Odisha.	16
2	31.07.12	District Sericulture Office, Suri, Birbhum, West Bengal.	11
3	13.08.12	Directorate of Sericulture, Kalimpong, Dareejling, WB.	27
4	01.09.12	Assistant Director of Industries (Seri), Purnia, Bihar.	34
5	01.11.12	Mulberry & Eri Silk Dev. Project, Kishanganj, Bihar.	32
6	19.11.12	Directorate of Sericulture, Govt. Of West Bengal, Siliguri, West Bengal.	15
7	26.11.12	Sericulture Training Institute under the Directorate of Sericulture, Govt. Of West Bengal, Berhampore, Murshidabad, West Bengal.	09
8	27.12.12	Sri Rupak Roychoudhury and Associates.	06
9	16.01.13	District Sericulture Office, Suri, Birbhum, West Bengal.	21
10	16.02.13	Assistant Development Director (Resham) under Directorate of Industries (Seri), Purnia, Bihar.	43
12	12.03.13	Mulberry & Eri Silk Dev. Project, Kishanganj, Bihar.	21
Total			235



5.F. TRAINING/ WORKSHOPS ATTENDED BY THE SCIENTISTS

Institute/ Place	Subject	Duration	Participants
Training conducted for scientists by the DST, New Delhi at Management Development Institute, Gurgaon Haryana.	Science Policy and Management Competencies	11 th -22 nd Feb., 2013.	Zakir Hossain, Sci-C
UGC- Network Resource Centre in Biological Sciences (UGC-NRCBS), Madurai Kamaraj University, Madurai, Tamil Nadu.	XXVI-Winter School on “Plant Cell Culture”	8 th -22 nd Oct., 2012	Mrs. N. Lalitha, Sci-B
Corporate & Enterprise Development Cell, Central Silk Board, Bangalore.	Training the Trainers’ program	11 th – 15 th Sept., 2012	Dr. S Chattopadhyay, Sci-C
Regional Office, Central Silk Board, Kolkata, West Bengal.	Training prog. on RTI Act, 2005	18 th -19 th Dec., 2012	Smt C. Maji, Scientist- D
Central Sericultural Research and Training Institute, Berhampore.	Training of RFD Nodal Officers	31.08.12	Dr. M. D. Maji, Sci-C and R. L. Ram, Sci-B
DST, New Delhi at Management Development Institute, Gurgaon, Haryana.	Science Policy and Management competencies.	11 th – 22 nd Feb., 2013	Zakir Hossain, Sci-C
C&ED Cell, Central Silk Board, Bangalore.	Training the trainers prog.	11 th -15 th Sept., 2012	Dr. Jalaja S. Kumar, Sci-C
Dy. Director, Textiles (Seri.), Suri, Birbhum, West Bengal, at Kanupur (Under Nalhati TSC) and Mollarpur (Under Mollarpur GC) to acquaint the sericulturists with the latest technologies.	Workshop cum Seminar.	14 th -15 th March, 2013	Dr. A. K. Misra, Sci-C, Dr. Ranjit Kar, Sci-C

5.G. TRAINING PROGRAMMES COORDINATED / CONDUCTED

Institute / Place	Subject	Duration	Coordinator
Deep Narayan Singh Regional Institute of Co-operative Management, Shastri Nagar, Patna.	Resource Dev. Prog. (RDP) of the Directorate of Handloom & Sericulture, Govt. of Bihar.	28 th Jan. - 3 rd Feb., 2012	Dr. S Chattopadhyay, Sci-C on behalf of the C&ED Cell, CSB, Bangalore.



6. AWARDS AND RECOGNITIONS

6. A. ISO 9001-2008 Award

CSR&TI, Berhampore has been **accredited with ISO 9001-2008 Certificate on 17th January, 2013.**



6.B. Ph.D. Award

Awarded Ph.D. degree to Smt. Manoja Patnaik, Scientist-C, Entomology Section of the Institute by the University of Kalyani, Kalyani, West Bengal in Sept., 2012.

7. COLLABORATIVE RESEARCH PROJECTS & ROGRAMMES WITH OTHER INSTITUTES /ORGANIZATIONS

7. A. DBT funded: *Collaboration with CCMB, Hyderabad.*

7. A.1. PIG-3441: Development, validation and utilization of SCAR marker(s) for powdery mildew (*Phyllactinia corylea*) resistance in mulberry. (Nov., 2009 to Aug., 2013) (Sanction No. BT/PR11675/ PBD/19/ 196/2008 dated 12.10.2009)

B. B. Bindroo (PI), R. Banerjee, S. Chattopadhyay and S. Sarkar (JRF)

Objectives: Development of SCAR marker(s) linked to resistance response to powdery mildew. Validation of the developed SCAR marker(s) for their stability/ inheritance using powdery mildew specific mapping progenies. Testing the validated SCAR marker (s) for their potential utility as efficient selection markers in MAS approach based disease resistance breeding.

At the Institute: Development of powdery mildew specific segregating progeny. Development of advance breeding lines by transfer of resistant trait to commercial cultivar for MAS based breeding approach. Evaluation of both segregating population and advance breeding lines for powdery mildew resistance and associated features for SCAR validation and utilization potential assessment.

Evaluation of powdery mildew specific segregating pseudo F₂ (F₁) populations for resistance:

Powdery mildew specific segregating population (about 260) derived from the crosses of Vientnam-2 (resistant donor) with Kolitha-9, Philippines and Xuan-9 (susceptible recipients) was established in the experimental field of the Institute in ARBD for validation of putatively developed SCAR markers and associated



inheritance study. Disease reactions were scored six rounds coincided with the Aghrayani (Oct.– Nov.) and Falguni (Jan.–Feb.) commercial silkworm rearing seasons of West Bengal over three consecutive years (2010-2012) to get the stable expression of powdery mildew. Disease severity index (DSI) across the progenies ranged from 1.7 to 39.9. DSI variation of progeny of Philippines x Vietnam-2 was maximum with around 6 fold, followed by Xuan-9 x Vietnam-2 (~4 fold) and Kolitha-9 x Vietnam-2 (~3.5fold) (Table 30).

The overall nature of cumulative DSI values of three segregating progenies exhibited normal distribution (Fig. 6). Segregation pattern of Kolitha-9 x Vietnam-2 and Philippines x Vietnam-2 descendents fitted well with 3:1 (susceptible: resistant), while, progenies of Xuan-9 x Vietnam-2 followed 1:1 segregation.

Table 30. Disease severity index of powdery mildew specific segregating progenies.

	DSI		Progeny based on disease reaction (No.)				
	Mean	Range	R	MR	MS	S	Total
Parents							
Vietnam-2	0.30	0.01-1.3		-	-	-	
Kolitha-9	28.8	27.4-34.6	-	-	-		
Philippines	30.9	34.1-40.5	-	-			
Xuan-9	27.9	29.2-34.7	-	-	-		
Progenies							
Kolitha-9 x Vietnam-2	19.0	5.2-30.1	2	7	29	9	47
Philippines x Vietnam-2	20.6	1.7-39.9	2	13	43	25	83
Xuan-9 x Vietnam-2	20.6	2.02-32.8	1	12	89	28	130
LSD (<i>P</i> 0.05)	2.64						

Data are mean of six seasonal observations with three replications per progeny per season. R= resistant, MR=moderately resistant, MS=moderately susceptible and S= susceptible.

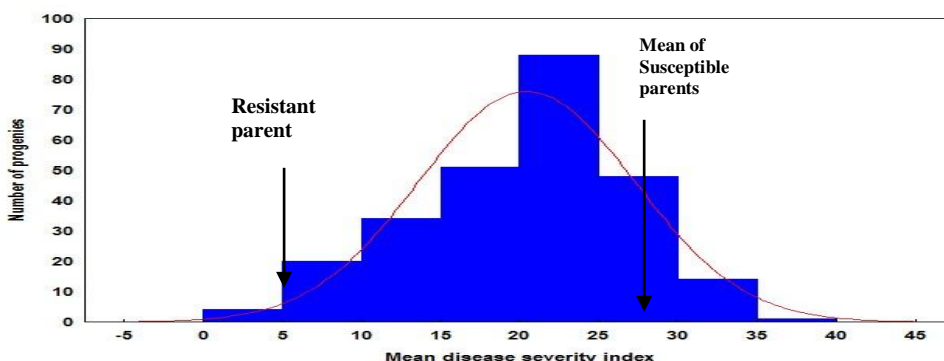


Fig.6: Pooled disease severity index based frequency distribution of pseudo-F₂ progenies derived from three powdery mildew specific segregating progenies [Eleven DSI value classes that are increment of 5 units per class during natural epiphytotics of powdery mildew]



Defense associated micro-morphological and biochemical evaluation across the progenies indicated significant variability supported the contrastness of selected parental lines/ progenies for the study. Among the tested 8 traits, DSI values showed strong association with total phenol ($r = -0.74$; $p > 0.01$) and trichome density ($r = -0.77$; $p > 0.01$; Fig. 7 a,b).

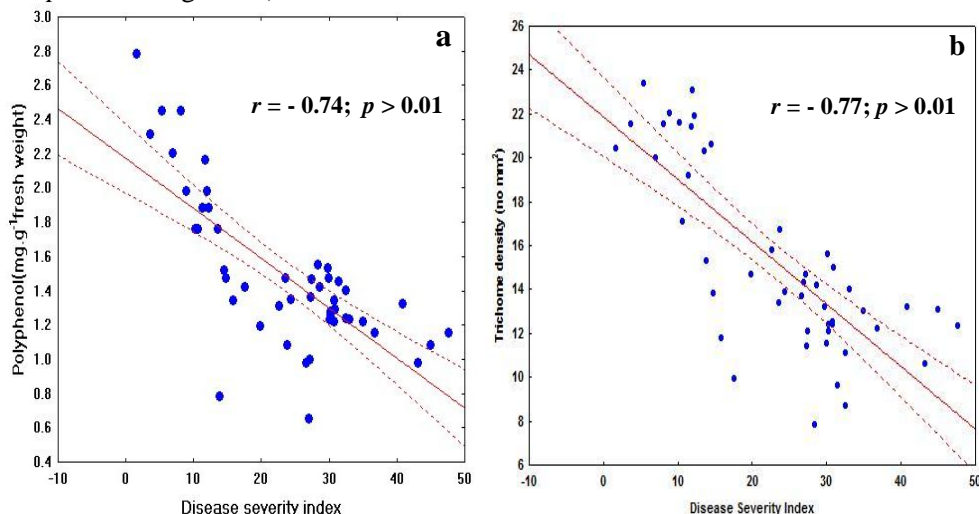


Fig.7: Association of powdery mildew disease severity index with a) polyphenol content and b) trichome density.

Additionally, about 30 contrast responsive selected progenies to powdery mildew were analyzed through 20 each of RAPD and ISSR primers (Figure 8). Nine RAPD and 11 ISSR primers produced 56 and 114 polymorphic bands, respectively. Three primers each from two groups were selective for resistance/ susceptible response (Table 31).

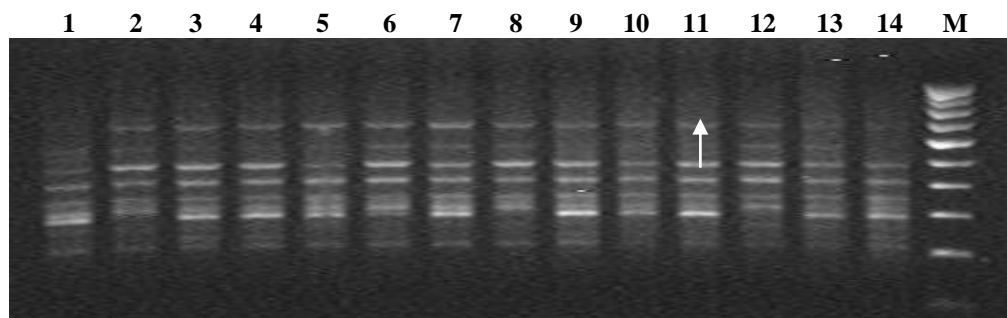


Fig. 8. DNA amplification profiles of selected mulberry progeny employing ISSR primer UBC-880. Lanes 1-8 resistant, lane 9 -14 susceptible progenies and M markers and arrow marks: polymorphic band.

Development of advance breeding lines for possible use in MAS based selection: Efforts were made to transfer resistance trait of Vietnam-2 to S-1 (powdery mildew susceptible) to test the utility potential of developed / validated SCAR markers for possible MAS base advancement.

Table 31: Three each of promising RAPD and ISSR primers polymorphic to powdery mildew specific contrast responsive progenies.

	Primer	Sequence	Polymorphic bands/ No.	Polymorphism (%)
RAPD	OPC-5	5'-GATGACCGCC-3'	11	63
	OPC - 16	5'-CACACTCCAG-3'	10	57
	OPC -19	5'-GTTGCCAGCC-3'	9	53
ISSR	UBC -880	5'-GGAGAGGAGAGGAGGA-3'	7	42
	UBC-809	5'-(AG)8G-3'	9	47
	UBC-815	5'-(CA)8T-3'	5	43
Average of 9 RAPD			8.7	52.2
Average of 11 ISSR			7.0	44.0

Subsequently, randomly selected progeny ~ 120 Nos. was established in ARBD during 2011 and three round evaluation of powdery mildew disease reaction, foliage biomass along with 10 other associated morphometric traits were evaluated. Data showed introgression of powdery mildew resistance to 8 lines with average of about 6.2 fold increment over susceptible (S-1) parent; two of them exhibited 15-21% higher leaf biomass potential over commercial cultivar S-1 (Table 32).

Table 32: Powdery mildew disease severity index and leaf biomass of selected lines derived from the cross of S-1 with Vietnam-2.

Parent / progeny	DSI	Leaf mass (kg plant ⁻¹)	% increase over S-1
15-08	4.78	0.14	--
15-10	2.14	0.26	15
15-12	2.40	0.19	--
15-28	2.74	0.22	
15-22	5.82	0.28	21
15-32	5.73	0.17	-
15-40	3.73	0.15	-
15-45	6.67	0.12	-
Resistant (V-2)	0.83	0.19	
Susceptible (S-1)	26.54	0.23	
LSD (P 0.05)	1.7	0.085	



Data are mean of three seasonal observations with three replications per progeny/ parent per season. In CCMB, 13 SCAR primer pairs were initially validated with 29 reference panel (resistance / susceptible germplasm) and then tested on 143 genotypes used in earlier project. The putative SCAR primers showed high positive association with phenotypic powdery mildew resistance response in two cases and with susceptible disease reaction in one case. Validation process of segregating powdery mildew specific progenies with these three SCARs and some mulberry specific genic SSRs are under progress.

7.A.2. Development of DNA marker based genetic linkage map of mulberry and QTL analysis for agronomically important *planta* traits. (March, 2011 to Feb., 2014) (Sanction No. BT/PR11872/PBD/ 19/ 200/2009; 16.03.2011; in collaboration with CCMB- Hyderabad)

R. Banerjee (PI), S. Chattopadhyay and D. Biswas (JRF).

Generalized objectives: Development of mulberry specific SSR markers for genetic studies. Extensive phenotyping of the mapping population derived from ‘Mysore local X V-1’ for agronomically important *planta* traits and major foliar diseases. Construction of reasonably dense molecular linkage map and identification of major QTLs for important phenotypic traits. Development of third generation population utilizing promising progeny lines.

At the Institute: Extensive phenotyping of the mapping population for various agronomical traits and responses of important foliar diseases. Identification/crossing of some promising progeny plants for possible trait refinement and/or mapping validation.

A segregating mapping populations (150) derived from cross of two cultivars Mysore local x V-1 were established in ARBD in five blocks each with two sets of parents. *In planta* characterization of morpho-agronomic traits across the population showed significant variability. Continuous frequency distribution was observed for 6 out of 11 quantitative traits, of which, lamina length, lamina width, petiole length and shoot number were noteworthy. Segregations of aforementioned traits were transgressive over better parent (Fig. 9).

Significant heterosis in the traits was also observed (Table 33). Mximum high parent heterosis was observed in lamina width (61.2%), followed by shoot number (22.8%). While, moderate levels of HP heterosis were observed for primary shoot length (8.8%), petiole length (8%), lamina length (7.6%) and petiole width (6.1%).



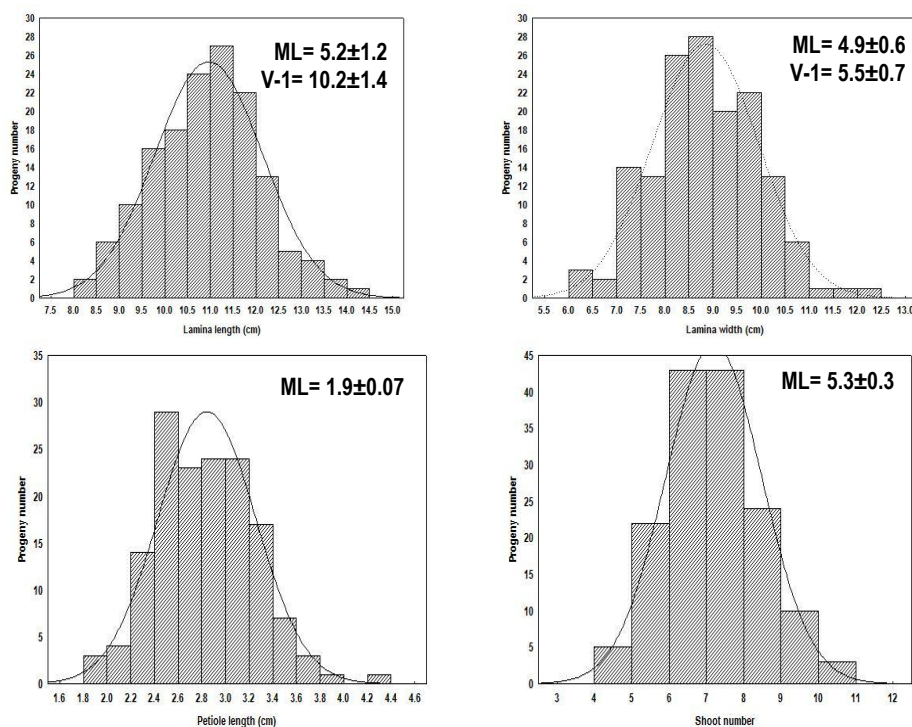


Fig. 9: Frequency distribution of various four important agronomic traits in the mapping population derived from cross of Mysore local x V-1

Table 33: Heterosis in agronomical parameters in progeny derived from the cross of Mysore local x V-1.

Parameter	Female parent (Mysore local)	Male parent (V-1)	Hybrid	High parent heterosis
Primary shoot length (cm)	92.3±2.72	105.2±2.9	114.5±1.2	8.80
Petiole length(cm)	1.9±0.07	2.6±0.1	2.84±0.03	8.02
Petiole width(cm)	0.2±0.03	0.3±0.01	0.3±0.01	6.13
Shoot number(no)	5.3±0.3	6.4±0.2	7.2±0.1	22.81
Lamina length(cm)	5.2±1.2	10.2±1.4	11.0±0.1	7.6
Lamina width(cm)	4.9±0.6	5.5±0.7	8.8±0.9	61.16

Besides, significant variability was observed between identified representative progeny lines (20 Nos) contrasting in response to foliage yield and other important agronomic traits while evaluated for different parameters (Table- 34). Obtained results indicated >25% increment over better parent (V-1) in the high-

yielding group in leaf biomass (27%), petiole width (26.4%) and shoot length (21.7%) respectively and lamina width (78.3%) recorded the maximum increase.

Table 34: Leaf mass and agronomical features of selected progenies with contrasting foliage yield and associated parameters derived from the cross of Mysore local x V-1.

Parent/Progeny	LM	LA	SL	SN	PL	PW	LL	LW
<i>Parent</i>								
Mysore local	242.1	85.4	92.3	5.3	1.97	0.21	5.23	4.97
V-1	345.6	135.7	105.2	6.4	2.63	0.25	10.17	5.48
<i>High foliage mass (HY) progeny</i>								
2353	427.9	150.3	127.5	7.3	3.0	0.23	12.2	9.2
2307	509.7	159.0	129.4	7.6	3.5	0.34	13.3	11.8
1675	455.2	143.7	118.9	7.1	2.9	0.53	11.2	8.5
2241	481.1	121.0	153.4	9.4	2.9	0.27	10.9	9.2
750	555.5	170.7	127.6	9.6	2.8	0.29	11.9	10.2
Mean	438.9	148.5	128.0	8.1	3.1	0.32	12.0	9.8
<i>Low foliage mass (LY) progeny</i>								
2417	137.5	132.0	112.4	6.6	2.3	0.21	9.5	7.5
1923	165.3	101.3	111.4	4.1	2.7	0.22	10.0	8.1
772	131.9	66.7	115.8	4.7	3.0	0.18	9.3	7.7
371	139.6	118.7	89.6	5.2	2.5	0.20	8.5	8.2
Mean	164.5	96.3	97.4	5.5	2.5	0.21	9.5	7.8
LSD _(0.05)	106.7	13.1	25.2	1.7	0.7	0.2	11.5	3.4
<i>t</i> value HY. vs. LY.	**	**	**	**	**	**	**	**

** denotes $P < 0.01$ [LM: Leaf mass ((g plant⁻¹), LA: Leaf area (cm²), SL: Shoot length (cm), SN: Shoot number (no), PL: Petiole length(cm), PW: Petiole width(cm), LL: Lamina length(cm), LW: Lamina width(cm)].

Additionally, parental DNA (Mysore local and V-1) was analyzed with 10 mulberry specific SSRs. Three SSRs (SR-1, 2 and 6) showed polymorphism between two parents (Fig. 5a). Analysis of selected progeny lines with these three SSRs is under progress. Besides, DNA fingerprinting of two parents along with 6 progenies each with high/low yielding groups were conducted with RAPD and ISSR primers. Out of 20 RAPD primers tested, 5 produced distinct polymorphic banding patterns (data not shown.). Similarly, 5 out of 20 tested ISSR primers produced 58 polymorphic markers with 21.55 markers per primer (Fig.10 a,b).



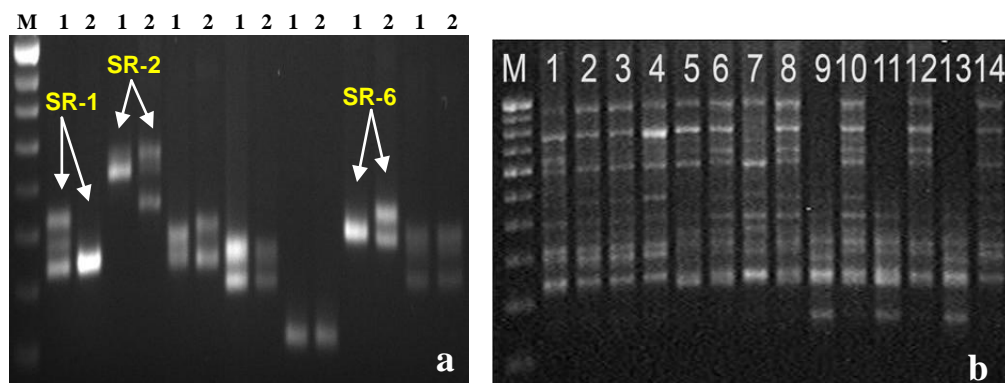


Fig.10: DNA amplification profiles of a) parental line Mysore local (1) and V-1 (2) with 7 SSR primers [SR-1 to SR-7] and b) contrast responsive progenies for leaf yield using ISSR primer UBC-880 [M: Marker, 1:ML, 2:V-1, 3-8: low and 9-14: High yielding progenies]

Further, evaluation of two major leaf spot diseases i.e. *Xanthomonas* leaf spot (XLS) and *Myrothesium* leaf spot (MLS) have been conducted their respective peak season of incidences (XLS: June /Shravani, 2012 and August/ Bhaduri, 2012; MLS: July-August/ Bhaduri, 2012 and Sept.-Oct./ Asiwna, 2012) under natural inoculums. Significant variabilities of disease severity values were observed for XLS (DSI range: 4.6 to 38.8) and MLS (DSI range: 4.1 to 31.6). The segregation pattern of MLS severity fits well with Mendelian ratio of 3:1 (susceptible: resistant) suggesting monogenic control of the resistant trait; while, XLS segregation was continuous and therefore seems polygenic in nature. Controlled crossing prog. has also been undertaken for trait refinement during Jan.- Feb., 2012 and 2013 utilizing 5 identified promising lines based on foliage yield as well as disease resistance to XLS and MLS through sib-mating and backcross breeding.

In CCMB, parental polymorphism has been completed with 75 mulberry specific SSRs, which have identified ~28 polymorphic SSRs useful for mapping. These are presently under use to generate segregation data for the mapping progenies. Besides, few robust QTLs for two leaf traits are under progress using CSR&TI Berhampore generated phenotyping data.

7. B. CSB funded: Collaboration with CSGRC, Hosur

7.B.1. AIE 3454: Evaluation of elite bivoltine silkworm germplasm under different agro-climatic conditions: All Silkworm Germplasm Evaluation. Prog. (Phase II) (Sept., 2011 to Aug., 2014) (Net Working Project)

M. K. Singh (PI) and T. Dutta (Biswas)

Objectives: To identify the suitability of Bivoltine silkworm Germplasm for specific agro climatic area. To identify the Bivoltine Silkworm Germplasm, which have a wide adaptability to varied climatic condition. To identify the



potential germplasm as parent for silkworm hybridization programme suitable for different agro climatic condition.

During autumn (Nov., 12), maximum larval weight (45.2g.) was recorded in BBE-216 and maximum ERR% (90.4) in BBI-348. However, other economical characters showed highest value in BBE-263 i.e., Single Cocoon wt. (1.83g.), Single Shell wt. (0.373g.) and Shell % (22.4). During spring (Feb.,-March, 13) maximum larval weight (45.4 g) was recorded in BBE-263, ERR% (98) in BBI-329 followed by the local control (96). Accession No. BBI-263 registered the highest single cocoon wt. (0.29 g) followed by BBI-338 and BBI-348 (0.28 g). However, highest shell% (21.6) was recorded in National control (Table 35A & 35B).

Table 35 A. Rearing performance of genetic resources during Autumn season.

Sl. No.	Accession No.	Weight of 10 mature larvae (g)	ERR%	Single cocoon wt (g)	Single shell wt (g)	Shell %
1	BBE-164	42.500	64.00	1.66	0.320	19.29
2	BBE-329	40.830	66.40	1.56	0.287	17.30
3	BBE-268	44.395	65.20	1.77	0.360	21.68
4	BBE-202	41.920	65.20	1.75	0.347	20.90
5	BBE-266	42.840	62.00	1.77	0.355	21.36
6	BBE-225	39.290	63.20	1.58	0.309	18.62
7	BBI- 338	40.680	63.20	1.80	0.367	22.12
8	BBE- 263	42.045	54.40	1.83	0.373	22.44
9	BBE-216	45.160	78.40	1.76	0.352	21.22
10	BBI-348	41.230	90.40	1.72	0.345	20.79
11	Local control	40.825	70.40	1.63	0.310	18.68
12	National control	37.925	55.20	1.45	0.300	18.09

Table 35 B. Rearing performance of genetic resources during spring season.

Sl. No.	Accession No.	Weight of 10 mature larvae (g)	ERR%	Single cocoon wt (g)	Single Shell wt (g)	Shell %
1	BBE-164	35.794	68.40	1.23	0.217	17.59
2	BBE-329	35.995	98.00	1.39	0.232	16.69
3	BBE-268	37.163	89.20	1.31	0.253	19.26
4	BBE-202	36.218	63.20	1.37	0.239	17.41
5	BBE-266	NOT HATCHED				
6	BBE-225	35.228	69.60	1.22	0.235	19.19
7	BBI- 338	38.804	64.00	1.36	0.286	21.97
8	BBE- 263	45.435	77.60	1.54	0.292	18.98
9	BBE-216	40.408	76.40	1.34	0.247	18.49
10	BBI-348	42.295	88.40	1.44	0.284	19.77
11	Local control	38.875	96.00	1.44	0.253	17.58
12	National control	36.290	62.40	1.27	0.273	21.58



7.C.1. AIB 3491: Post Authorization trials of silkworm hybrids in Eastern and North Eastern India. (Sept., 12 to Dec., 2014) [With NSSO & CSTRI, Bangalore]

N. Suresh Kumar (PI), G.K. Chattopadhyay and ICs of respective test centres.

Objective: To popularize authorized hybrids in Eastern and North Eastern India.

During Agrahayani crop, total 75550 dfls of Multi x Bi were distributed among 807 farmers of West Bengal and Jharkhand states. An average cocoon yield of 62.9 kg, 65.5 kg and 55.3 kg/100 dfls was obtained in M. Con.1 x B. Con.4, M. Con.4 x B. Con.4 and N x NB4D2 (control), respectively.

Table 36. Rearing performance of multi x bi hybrids under PAT during Agrahayani crop

Sl. No.	Name of the test centre	No. of farmers	No. of dfls	Yield/100 dfls (kg)	Yield range
M.Con.1 x B.Con.4					
1	REC, Kamnagar	30	3000	66.28	66.6~70.7
2	Sub REC, Rajmahal	14	700	70.54	65.0~77.5
3	REC, M. P. Raj	16	800	54.88	48.6~58.5
4	REC, Mothabari	23	3000	62.66	57.5~65.0
5	DoT (Seri) MSD	17	1700	60.63	52.0~67.5
6	ZSSO Malda	17	1650	63.98	53.0~69.5
Total/ Average		124	11150	62.89	
M.Con.4 x B.Con.4					
1	REC, Kamnagar	50	5000	68.80	60.6~70.7
2	Sub REC, Rajmahal	25	2000	72.76	68.8~78.8
3	REC, M. P. Raj	19	1000	60.78	65.0~64.8
4	REC, Mothabari	50	5050	66.47	60.3~70.0
Sl. No.	Name of the test centre	No. of farmers	No. of dfls	Yield/100 dfls (kg)	Yield range
5	DoT(Seri), MSD	15	1500	63.75	58.3~68.0
6	DoT(Seri), Birbhum	40	4000	63.75	57.5~70.0
7	DoT(Seri), Nadia	20	2000	62.50	55.2~67.0
8	ZSSO, Malda	39	3850	65.44	60.3~70.0
Total/Average		258	24400	65.53	
N x NB4D2					
1	REC, Kamnagar	20	2000	57.55	55.6~59.6
2	Sub REC, Rajmahal	45	4000	52.60	50.0~60.0
3	REC, M.P.Raj	47	2700	50.95	43.4~53.6
4	REC, Mothabari	50	5000	54.16	52.5~63.4
5	DoT(Seri), Malda	55	5000	60.50	47.5~63.1
6	DoT(Seri),MSD	68	6800	54.38	46.5~62.5
7	DoT(Seri), Birbhum	60	6000	52.50	44.8~59.5
8	DoT(Seri), Nadia	30	3000	60.00	50.5~65.5
9	ZSSO, Malda	50	5000	54.88	48.5~62.6
Total/ Average		425	40000	55.28	
Grand total		807	75550		



8. CENTRAL OFFICE PROJECTS & PROGRAMMES (NATIONAL)

8.1. All India Co-ordinated Experimental Trial on Mulberry (Phase-III) (April, 2011 to Dec., 2016)

Zonal Co-ordinator: B. B. Bindroo

Team Leader: M. K. Ghosh

S. N. Gogoi, G. S. Singh, R. Sahu, M. D. Maji and L. S. Singh.

Objectives: To identify and authorize suitable mulberry variety for commercial use in different agro-climatic mulberry cultivation zones of India.

Experimental Layout:

- ❖ Mulberry varieties : 5
- ❖ Entries for all Test centers except Kalimpong and Sahaspur: MV1 (C2038), MV2 (FYT/99-G4), MV3 (Suvarna-2), MV4 (Vishala) and MV5 (S-1635).
- ❖ For Kalimpong and Sahaspur: MV1 (C2038), MV2 (FYT/99-G4), MV3 (Suvarna-2), MV4 (Tr-23), MV5 (Vishala) and MV6 (S-146).
- ❖ Experimental Design : RBD
- ❖ Replications : 6
- ❖ Spacing : 90 cm × 90 cm
- ❖ Total No. of plants/plot : $9 \times 9 = 81$
- ❖ No. of experimental plants/plot : $7 \times 7 = 49$ (excluding border plants)
- ❖ Block size : $L \times B = 40.5 \times 8.1 = 328.05$ sq.m
- ❖ Experimental area : $328.05 \times 6 = 1968.3$ sq.m

Progress made are as follows:

Sl. No.	Test Centres	Progress
1.	CSR&TI, Berhampore, West Bengal	<ul style="list-style-type: none"> • Transplantation completed by March, 2012. • Gap filling done. • Plantation ready for giving first pruning.
2.	RSRS, Koraput, Odisha	<ul style="list-style-type: none"> • Transplantation completed on 07.07.2012. • First pruning to be given by 4th Week of June, 2013.
3.	RSRS, Jorhat, Assam	<ul style="list-style-type: none"> • Transplantation completed on 03.01.2012. • First pruning done.
4.	RSRS, Kalimpong, West Bengal	<ul style="list-style-type: none"> • Transplantation completed on 14.03. 2012. • First pruning to be given by 2nd week of June, 2013.



Sl. No.	Test Centres	Progress
5.	RSRS, Ranchi, Jharkhand	<ul style="list-style-type: none"> Transplantation completed on 22.08.2012. First pruning to be given by 3rd week of July, 2013.
6.	REC, Imphal, Manipur	<ul style="list-style-type: none"> Transplantation completed on 30.07.2012. First pruning to be given by 4th week of June, 2013.
7.	DoT (Seri) Farm Ambari Falakata, Dist. Jalpaiguri, West Bengal	<ul style="list-style-type: none"> Transplantation completed on 25.03.2012. First pruning to be given by 2nd Week of June, 2013.
8.	DoT (Seri) Farm, Boswa Composit Unit Boswa, Birbhum, West Bengal	<ul style="list-style-type: none"> Transplantation completed on 30.10.2012. First pruning to be given by 4th week of Sept., 2013.

8.2. Mulberry Silkworm Race Authorization Prog. (MSRAP) (Phase–VIII) (Jan., 2011 to Dec., 2012) (Concluded)

Zonal Coordinator: B. B. Bindroo

H. Lakshmi (**PI**), N. Suresh Kumar and A. K. Saha

Objective: To identify region and season specific hybrids.

A total of 8 centres namely, RSRS, Jorhat, RSRS, Ranchi, RSRS, Koraput, RSRS, Kalimpong, Piasbari Farm, DoT (Seri), Kolitha, DoT (Seri) West Bengal, STI, Shillong, DOS Farm, Aizawl are under the jurisdiction of this institute. Bivoltine hybrids: 4 centres and multi x bi hybrids: 5 centers (RSRS Koraput for both bi x bi and multi x bi hybrids).

Multi x Bi hybrid: M6DPC x SK4C stood first followed by Nistari x (SK6 x SK7).

Bi x Bi hybrid: The double hybrid (CSR50 x CSR52) x (CSR51 x CSR53) stood first followed by CSR50 x CSR51 and CSR28DR x CSR21DR.



9. RESEARCH PUBLICATIONS

Sl. No.	Particulars	Total
1.	Research papers:	
	A. International journals	28
	B. National journals	35
2.	Research articles	22
3.	News/ reports/silk briefs	57
4.	Books	11
5.	Book Chapters	2
6.	Booklet	1
7.	A. Brochures	2
	B. Pamphlets	7
	C. Bulletins	1
	D. Calendars	2
	E. Leaflet	1
8.	Proceedings of Seminar/ Workshop/ Symposium	17
9.	Abstracts of presented papers in Workshop/ Seminar/ Conference.	
	A. International	06
	B. National	27
	Total	219

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A. International

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IV. BOOKS

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9. M. K. Ghosh and B. B. Bindroo (2012). Integrated Skill Development Scheme on Mulberry Cultivation. (In English & Bengali).
10. S. Roy Chowdhuri, S. K. Mukhopadhyay and B. B. Bindroo (2012). Skill Updation for Extension Agents. (In English & Bengali).
11. S. Roy Chowdhuri, M. K. Singh and Z. Hossain (2012). Training Manual for RFD Nodal Officers.

V. BOOK CHAPTER

1. Major pest of mulberry and their management by Dr. Manoj patnaik in Sericulture compendium published by Training Division, CSR&TI, Berhampore (W.B.). **Bookchapter-4.**
2. David, B. V. and Bandyopadhyay, U. K. (2012). Whiteflies of mulberry *Morus alba* L. in India. In “**The Whitefly or mealy wing bug**” published by LAP LAMBERT, Academic Publishing, Germany. p.224 - 242.

VI. BOOKLET

1. Chanda, S., Mukhopadhyay, S. K., Santha Kumar, M. V., Das, D. and Bindroo, B. B. (2013). *Resham Chaser Samagrik Prajukti* (Bangla).



VII. BROCHURES/ PAMPHLETS/ BULLETINS/CALENDERS

A. BROCHURES

1. Technology evolved and various activities of Silkworm Pathology Section (Hindi).
2. Pandit, D., Mukhopadhyay, S.K., Chanda, S., Das, D., Santhakumar, M. V. Do's and Don'ts for better harvest of mulberry cocoon. Brochure No. 13 (Trilingual), January, 2013.

B. PAMPHLETS

- 1) Bandyopadhyay, U.K, Maji, C and Bindroo, B. B. (2013) **Leaf webber *Glyphodes pyloalis* Walker and its eco-friendly management.** Pamphlet No. 5 (English), February 2013.
- 2) Bandyopadhyay, U.K, Bhutia, R, Maji, C and Bindroo, B. B. (2013). **Kimboko patma lagne leaf webber kira ani yaslai rokne parjabaran anukul babyastapan.** Pamphlet No. 5 (Nepali).
- 3) Maji, M. D., Maji, C and Bindroo, B. B. (2013). **Mulberry diseases of sub-tropical hills and their management.** Pamphlet No. 6 (English).
- 4) Maji, M. D., Maji, C and Bindroo, B. B. (2013). **Parbatya chetrama kimboko botma lagne bibhinna roghoru ani yasko babyastapan.** Pamphlet No. 6 (Nepali).
- 5) Pachuau, L., Choudhury, B.N. and Vanlallawma (2013). **Maimaw Pangang Natnavei Thin Te.** Pamphlet No.7 (Mizo).
- 6) Choudhury, B.N., Pachuau, L and Vanlallawma, C (2013): **Thingtheihmu Natna Tlanglawn Leh A Inven Dan Tlangpuite.** Pamphlet No.8 (Mizo).
- 7) S. K. Dutta, M. K. Ghosh and B. B. Bindroo. (2013). (Bengali) **Toot gacher rogo pratikarar upay.** Pamphlet No-9 (Bangla).

C. BULLETINS

1. News & Views, December, 2011 & June, 2012.

D. CALENDARS

1. Chanda, S., Mukhopadhyay, S.K., Das, D. and Santha Kumar, M.V. Event Calendar for Extension Communication Programme 2012-13.
2. Chanda, S., Mukhopadhyay, S.K., Das, D. and Santha Kumar, M.V. Training Calendar for Farmers' Field School 2012-13.

E. LEAFLETS

1. Purohit, K.M., Das Mahapatra, D.P. and Bindroo, B. B. (2013). Tut Bagichare Roga Parichalana. pp.1-6 (Oriya -REC, Deogarh).



VIII. PROCEEDINGS OF SEMINAR/WORKSHOP/ SYMPOSIUM:

Full Papes

1. Banerjee, R., Chattopadhyay, S., Sarkar, S. L.alitha, N., Saha, A. K. and Bindroo, B. B. (2013). Genotyping of germplasm resources and development of pseudo F₂ (F₁) mapping population for powdery mildew resistance in mulberry (*Morus* spp.). In: *Proceedings of International Seminar on Bioresources and Human Sustenance*. pp.153-159. Cotton College, Guwahati, Assam.
2. Bindroo, B. B., Suresh Kumar, N. and Saha, A. K. (2012). Present status, prospects and future strategies for the development of silkworm breeds/hybrids for eastern and north eastern India. *Paper presented at Silkworm breeder's meet held at CSB, Bangalore on 28th-29th May, 2012*.
3. Chanda, S., Saha, L. M, Das, N. K., Ray B. C. and Bindroo, B. B. (2012). Rearing of eri silkworm – an additional source of income for rural populace. *Proc. State Level Seminar on Advancement of Biological Science Towards Sustainable Development (State level Seminar in Berhampore Girls College on 29th – 30th March, 2012)*. pp. 83-97.
4. Chattopadhyay, S., Ali, K. A., Doss, S. G., Banerjee, R., Saha, A. K., Sarkar, A. and Bindroo, B. B. (2013). Association of anti-oxidant defense system with powdery mildew resistance in field grown mulberry (*Morus* spp.) germplasm. *Proceedings of International Seminar on Bioresources and Human Sustenance, Cotton College, Guwahati, Assam*. pp. 143-152.
5. Das, D., Mukhopadhyay, S. K., Bagchi, S. N., Dutta, A. K., Chatterjee, S., Chakraborty, S. P. and Bindroo, B. B. (2012). Institute Village Linkage Programme – An ideal mode for dissemination of technologies for sustainable sericulture. *Proc. State Level Seminar on Advancement of Biological Science Towards Sustainable Development (State level Seminar in Berhampore Girls College on 29th – 30th March, 2012)*. pp. 194-197.
6. Dutta, S. K., Maji, M. D. Ghosh M. K. and Bindroo, B. B. (2012). Scenario of mulberry (*Morus alba* L.) diseases in Murshidabad district and its prophylactic measure. *Proc. State Level Seminar on Advancement of Biological Science Towards Sustainable Development (State level Seminar in Berhampore Girls College on 29th – 30th March, 2012)*. pp. 155- 160.
7. Ghosh, M. K., Ghosh, P. K., Shiv Nath, Roy Choudhury, S., Singh, M. K. and Bindroo, B. B. (2012). Challenges in improving mulberry productivity and leaf quality for Eastern and North Eastern India: *Proc. State Level Seminar on Advancement of Biological Science Towards Sustainable Development (State level Seminar in Berhampore Girls College on 29th – 30th March, 2012)*. pp. 176 -186.



8. Kar, R. Majumdar, S. K. Ghosh, M. K. and Bindroo, B. B. (2012). Prospect of foliar sulphur supplement for escalation of productivity of aged mulberry (*Morus alba* L.) plant on a sulphur deficient soil. *Proc. State Level Seminar on Advancement of Biological Science Towards Sustainable Development (State level Seminar in Berhampore Girls College on 29th – 30th March, 2012)*. pp.169 - 175.
9. Misra, A. K. Palle, B., Tewary, P.K. Ghosh, M. K. and Bindroo, B. B. (2012). Study on the impact of weeds population weeds biomass on the growth and leaf yield of mulberry under different spacing. *Proc. State Level Seminar on Advancement of Biological Science Towards Sustainable Development (State level Seminar in Berhampore Girls College on 29th – 30th March, 2012)*. pp. 187-193.
10. Mitra, P., Chakrabarty S., Bandopadhyay P. K. and Haldar, D. P. (2012). Characterization of haemocyte types, their counts in different breeds of silkworm, *Bombyx mori* L. and their progressive changes following bacterial inoculation. *Proceeding of the 22nd Indian Congress of Parasitology 'Advances in Parasitology: A novel approach towards a disease free world'*, Department of Zoology, University of Kalyani, Kalyani-741235, West Bengal, India. Published by Prof. P. K. Banddyopadhyay, *Editor In Chief*, Printed at East India Photo composing Centre, 69, Sisir Bhaduri Sarani, Kolkata -700 006. pp.196 - 205.
11. Mukhopadhyay, S. K., Ralte, Lalremrauta and Bindroo, B. B. (2012). Management of whitefly in mulberry with biorational compounds. *Proc. State Level Seminar on Advancement of Biological Science Towards Sustainable Development (State level Seminar in Berhampore Girls College on 29th - 30th March, 2012)* pp. 204-207.
12. Patnaik, M., Bhattacharya, D. K., Saha, A. K. and Bindroo, B. B. (2012). Economics and effectiveness of some green pesticides on mulberry whitefly complex. *Proc. State Level Seminar on Advancement of Biological Science Towards Sustainable Development (State level Seminar in Berhampore Girls College on 29th – 30th March, 2012)*. pp.79-82.
13. Patnaik, B. B., Jayalakshmi, M., Saha, A. K., Rajakumar, S. and Bajpai, A. K. (2012). Study of natural hemagglutinins and their activity from the haemolymph of Silkworm, *Bombyx mori* L. *Proceedings of the 22nd National Congress of Parasitology, Advances in Parasitology: A novel approach towards a disease free world*. pp. 32-36.
14. Roy Chowdhuri, S., Singh, M. K., Ghosh, M. K., Hossain, Z. and Bindroo, B. B. (2012). Characterization of mulberry (*Morus*) germplasm and importance of conservation for sericulture development. *Proc. State Level Seminar on Advancement of Biological Science Towards Sustainable Development (State level Seminar in Berhampore Girls College on 29th – 30th March, 2012)*. pp. 208-213.



15. Saha, L. M., Chanda S., Dutta, R. N. and Bindroo, B. B. (2012). Studies on economic performance of private grainages at Kaliachak of Malda District, West Bengal. *Proc. State Level Seminar on Advancement of Biological Science Towards Sustainable Development (State level Seminar in Berhampore Girls College on 29th – 30th March, 2012).* pp. 119-128.
16. Santha Kumar, M.V., Dutta, P., Chakrabarti, S., Das, N. K., Mukhopadhyay, S. K., Saha, A. K. and Bindroo, B. B. (2012). Biology and feeding efficacy of *Brumoides suturalis*, A native predator of whitefly, *Aleuroclava pentatuberculata*. *Proc. State Level Seminar on Advancement of Biological Science Towards Sustainable Development (State level Seminar in Berhampore Girls College on 29th – 30th March, 2012).* pp. 214-226.
17. Singh, M. K., Naqvi, A. H., Roy Chowdhuri, S., Hossain, Z., and Bindroo, B. B. (2012). Mulberry sericulture: A suitable option in rainfed area of Jharkhand through technology intervention. In *Proc. State Level Seminar on Advancement of Biological Science Towards Sustainable Development (State level Seminar in Berhampore Girls College on 29th – 30th March, 2012).* pp. 199-203.

IX. ATTENDED & PRESENTED PAPER IN WORKSHOP/ SEMINAR/ SYMPOSIUM

Abstracts

International

- i) **International symposium on Food security dilemma: Climate change and plant health issues' AAPP, BCKV, Kalyani, West Bengal, India, 7th to 9th Dec., 2012.**
 1. Patnaik, M., Santhakumar, M. V., Saha, A. K., Bindroo, B. B. (2012). A new record of a native predator, *Scymnus pallidicollis* (Mulsant) on pink mealybug, *Maconellicoccus hirsutus* (Green) causing "TUKRA" in mulberry. Abs-021.
- ii) **Proceedings of 7th International Conference on Wild Silk Moth and Silk at Mahasarkhan Province, Thailand, on dated 22 to 24th Nov., 2012.**
 2. Pachuau, L., Choudhury, B. N. and Tikader, A. (2012). Conservation of wild silk Eri in Mizoram.
- iii) **Proceedings of International Conference on Insect Science held on 14th to 17th Feb., 2013 at University of Agricultural Sciences, Bangalore.**
 3. Santha Kumar, M. V., Dutta, P., Chakrabarti, S., Das, N. K., Mukhopadhyay, S. K. and Bindroo, B. B. (2013). Factors influencing the incidence pattern of whitefly, *Dialeuropora decempuncta* in mulberry.



- iv) **Indian Social Science Congress organized by Indian Academy of Social Sciences on 27th to 31st Dec., 2012 at Bhubaneswar, Odisha.**
4. Das, N. K., Das, K. K., Ghosh, M. K. and Bindroo, B. B. (2012). A study on comparative profitability in mulberry sericulture with prevailing agricultural multi-cropping pattern and adoption of sericulture by new farmers in West Bengal. Vol XXXVI, 2012. pp. 87.
- v) **International conference on Global meet of biologists organized by Indian Institute of Chemical Technology, Hyderabad on dated 26th to 28th Dec., 2012.**
5. Jalaja, S. K., Babu, A. M., Mishra, P. K. and Bindroo, B. B. (2012). SEM studies on the anatomical alterations in mulberry root leading to the formation of galls due to root-knot nematode, *Meloidogyne incognita*.
- vi) **International Conference on Anthropogenic Impact on the Environment and Bioremediation held on 2nd to 4th Nov., 2012 at Department of Biosciences, St. Xavier's College, Ranchi in collaboration with National Environmentalists Association, India, Ranchi, Jharkhand.**
6. Maji, C., Maji, M. D., Bandyopadhyay, U. K., Chatterjee, S., Ram, R. L., Bhutia, R. and Bindroo, B. B. (2012). Boost rearing performance through sericulture waste – a study. Abs. AZCE-5: 3, p. 103.

National

- vii) **Proceedings of National Seminar on Recent Trends in Research & Development in Muga Culture- ideas to Action, Guwahati, 3 – 4th May, 2012.**
7. Nirmal Kumar, S., Trivedi, K., Barah, A., Barman, H., Qadri, S. M. H. and Rajan, R. K. (2012). Semi-synthetic diet formulation and evaluation for young instar muga silkworm, *Antheraea assamensis*.
8. Trivedi, K., Nirmal Kumar, S., Barah, A., Qadri, S. M.H. and Rajan, R. K. (2012). Essential oil contents in fresh and dry som leaf, *Machilus bombycina* King- a comparative study.
- viii) **Proceedings of Centenary Session of Indian Science Congress in Agriculture and Forestry Sciences section held at Kolkata University on 3rd to 7th Jan., 2013.**
9. Biswas, D., Banerjee, R., Devi, S., Chattopadhyay, S., Saha, A. K. and Bindroo, B. B. (2013). Morpho-anatomical and molecular characterization of full-sib pseudo-F₂ (F₁) progeny of mulberry (*Morus* spp.) for improvement of foliage biomass. p.189.



10. Chakrabarty, S., Saha, A. K., Manna, B. and Bindroo, B. B. (2013). *Nosema bombycis* N. (Microsporida: Nosematidae) causing Pebrine disease in silkworm, *Bombyx mori* L.: A new improved method facilitate for observation of the diseases for sustainable development in sericulture. Abs. EP P- 61, p.393.
11. Das, D., Chatterjee, H., Santha Kumar, M. V., Das, N. K., Mukhopadhyay, S. K. and Bindroo, B. B. (2013). Population fluctuations of the root mealy bug, *Paraputo* sp. (Hemiptera: Pseudococcidae). Abs. EP- P, 26, p.402.
12. Datta (Biswas), T., Mejamongla, Saha, A. K. and Bindroo, B. B. (2013). Leaf silk conversion efficiency of silkworm, *Bombyx mori* L. feeding on different mulberry varieties (S1 & S 1635) and its utilization in the cocoon production. Abs. EP. 70, p.437.
13. Kar, R., Majumdar, S. K., Ghosh, M. K. and Bindroo, B. B. (2013). A study on variation of soil organic and inorganic carbon stock under nutrient management system on mulberry (*Morus alba* L.). Abs. G-37, pp.273- 274.
14. Lakshmi, H., Manu, P., Saha, A.K., Suresh Kumar, N., Mukherjee, S. Das, N. K., Bindroo, B. B. (2013). Identification of new foundation crosses of silkworm *Bombyx mori* L for commercial exploitation. Abs. Section II: Agriculture and Forestry Sciences. Abs. Ep-P-36, p.411.
15. Lalitha, N., Devi, L. M. Banerjee, R., Chattopadhyay, S., Saha A. K. and Bindroo, B. B. (2013), Effect of plant derived gelling agents as agar substitute in micropropagation of mulberry (*Morus Indica* L. cv. S-1635). p.136.
16. Ghosh, M. K., Bindroo, B. B., Ghosh, P. K., Shiv Nath, Roy Choudhury, S. and Misra A. K. (2013). Evaluation of newly developed promising mulberry varieties under irrigated conditions in the Gangetic alluvial soil of West Bengal. Abs. J-11, pp.316 -317.
17. Mukhopadhyay, S. K., Mawthoh, B., Santha Kumar, M. V., and Bindroo, B. B. (2013). Management of whitefly in mulberry with new potential insecticides. Abs. EP-O-16, p.375.
18. Sarkar, S., Chattopadhyay, S., Banerjee, R., Biswas, D., Saha, A. K. and Bindroo, B. B. (2013), Genetic analysis of segregation progenies of mulberry (*Morus* spp.) for powdery mildew (*Phyllactinia corylea*) resistance. p.119.
19. Roy Chowdhuri, S. and Partin, M. (2013). Studies on cytological behaviour in mulberry (*Morus* sp.). Abs. Section XIV: Plant Science. 249, p.207.
20. Saha, A. K., Naik, S. K. Suresh Kumar, N., Lakshmi, H., Bindroo, B.B. and Roy, S. (2013) Effect of photoperiod and scotoperiod on egg laying behaviour of silkworm *Bombyx mori* L. Abs. Section II: Agriculture and Forestry Sciences. Abs. EP-P-02, p.384.



21. Santha Kumar, M. V., Dutta, P., Chakrabarti, S., Das, N. K., Mukhopadhyay, S. K. and Bindroo, B. B. (2013). Critical factors influencing the incidence pattern of a native predator, *Micraspis crocea* (Coleoptera: Coccinellidae). Abs. EP-O-10, p.369.
 22. Suresh Kumar, N., Lakshmanan, V., Saha, A.K., and Bindroo, B. B. (2013). Development of bivoltine double hybrid of silkworm, *Bombyx mori* L. for hilly conditions. Abs. Section II: Agriculture and Forestry Sciences. JE-P-41, p.415.
 23. Verma, A. K., Bindroo, B. B., Santha Kumar, M. V. and Saha, A. K. (2013). Innerflux and distribution of the whitefly, *Bemisa tabaci* (Genn.) (Homoptera: Aleyrodidae). p.385.
- ix) National Seminar on Plant Genetic Research for Eastern and North-Eastern India held on 11th to 12th May, 2012 at Umiam, Meghalaya.**
24. Bindroo, B. B. (2012). Diversity and distribution of mulberry (*Morus spp.*) in North Eastern states of India. Abs. PS-II: 2, p.71.
 25. Chaudhuri, Monica, Jalaja S. Kumar, Roy Chowdhuri, S. and Bindroo, B. B. (2012). Retrospective analysis of historical weather variables and mulberry (*Morus alba* L.) foliage yield. Abs. PS-II: 8, p.76.
- x) National Symposium on Plant Microbe Interactions and Crop Health Management held on 6-7th Oct., 2012 at Visva Bharati, Dept. of Plant Protection, Palli Siksha Bhavana (Institute of Agriculture), Sriniketan, West Bengal.**
26. Chakrabarty, S., Saha, A. K., Manna, B. and Bindroo, B. B. (2012). *Meloidogynae incognita* Chitwood (Nematoda: Heterodoidea) causing Root Knot disease in Mulberry plant (*Morus alba* L.: Moraceae): Host pathogen interaction towards management. pp: 21-22.
 27. Chatterjee, S., Maji, M. D., Chakraborty, S., Bandopadhyay, U. K., Maji, C and Bindroo, B. B. (2012). Studies on effect of pruning on pest and disease infestation on mulberry of under sub-tropical hills Kalimpong. pp. 58-59.
- xi) National Symposium on Recent Trends in Plant and Microbial Research, 22nd to 23rd March, 2013, Department of Botany, University of North Bengal, Siliguri, Darjeeling, West Bengal, India.**
28. Maji, M. D., Maji, C. and Bindroo, B. B. (2013). Genetic diversity of mulberry (*Morus spp.*) genotypes of different agroclimatic origin to bacterial leaf spot caused by *Xanthomonas campestris* pv. *mori*. Abs. OP- 3, p.7.



- xii) **National Seminar on “Recent Advances in Life Science application” – Organized by Post Graduate Department of Zoology, Acharya B.N. Seal College, Cooch Behar in Collaboration with Department of Agricultural Entomology, UBKV, Pundibari, Cooch Behar held on 8th to 9th Dec., 2012.**
29. Dutta, S. K., Santha Kumar, M. V., Verma, A. K., Ghosh, M. K. and Bindroo, B. B. (2012). Study on *Lacipdiplodia theobromae*, a root rot fungi of mulberry (*M. alba* L.) in Malda district and its prophylactic measure. Abs. 22, p. 21.
- xiii) **National Symposium on Blending Conventional and Modern Plant Pathology for Sustainable Agriculture held on 4th to 6th Dec., 2012 at Indian Institute of Horticultural Research, Bangalore.**
30. Maji, M. D., Maji, C. and Bindroo, B. B. (2012). Epidemiology and prediction of *Myrothecium* leaf spot of mulberry caused by *Myrothecium roridum*. Abs. 07, pp.56-57.
- xiv) **National Symposium on Recent Trends in Plant and Microbial Research held on 22nd to 23rd March, 2013 at Department of Botany, University of North Bengal, West Bengal.**
31. Maji, M. D., Maji, C. and Bindroo, B. B. (2012). Genetic diversity of mulberry (*Morus* spp.) genotypes of different agroclimatic origin to bacterial leaf spot caused by *Xanthomonas campestris* pv. *mori*, Siliguri, Darjeeling. Abs. 3.07, p.29.
- xv) **Published in e-book form during Workshop Cum Brainstorming Session on Recent Advances in Post Cocoon Technologies for Tasar Silk Industry held on 11th July, 2012 at CSR&TI, Ranchi, Jharkhand.**
32. Kar, N. B., Majumdar, S., Majumdar, M. K. and Bindroo, B. B. (2012). Studies on the interactive features of machine, material and process parameters on cocoon and reeling characteristics of tasar cocoons *Antheraea mylitta* D.
33. Majumdar, S., Kar, N. B. (2012). Studies on the effect of different drying technique on dry reeling and wet reeling traits of tasar cocoons *Antheraea mylitta* D.



10. RESEARCH PROJECTS AND PROGRAMMES

Total projects: 51 (19 Projects + 2 Pilot study + 30 Prog.)

Projects: 19

Sl. No.	Code No.	Title	PI
1.	PIB 3424	Development of cold tolerant mulberry genotypes for sub-tropical plains. (Jan., 09 to Dec., 15)	M. K. Ghosh, Sc-D
2.	PPS 3435	Studies on micronutrients for sustained high productivity of quality mulberry in Eastern and North-Eastern India. (Collaboration with 4 RSRs) (Jan., 10 to June, 13)	R. Kar, Sc-C S. K. Majumder, Sc-C (upto 19/05/12)
3.	PPS-3452	Terrestrial carbon sequestration for sustained high productivity of quality mulberry. (July, 11 to June, 15)	R. Kar, Sc-C S. K. Majumder, Sc-C (upto 19/5/12)
4.	PIG 3441 (DBT)	Development, validation and utilization of SCAR marker(s) for Powdery Mildew (<i>Phyllactinia corylea</i>) resistance in mulberry. (In collab. with CCMB, Hyderabad). (Oct., 09 to Aug., 13)	B. B. Bindroo, Director
5.	(DBT)	Development of DNA marker based genetic linkage map of mulberry and QTL analysis for agronomically important <i>Planta</i> traits (Mar., 11 to Feb., 14)	R. Banerjee, Sc-C
6.	MOE-3459	Yield gap in mulberry sericulture – A study in North-Eastern region of India (Oct., 11 to April, 14)	M. Pamehgam, Sc-C
7.	ARE -3464	Biology and feeding efficacy studies of <i>Scymnus pallidicollis</i> (Mulsant) for the eco-friendly management of pink mealy bug, <i>Maconellicoccus hirsutus</i> (Oct., 11 to Sept., 13)	M. Patnaik, Sc-C
8.	AIB- 3466	Development of region specific bivoltine breeds suitable for highly fluctuating and seasonally variable climatic conditions of Eastern and North-Eastern India (Aug., 11 to Dec., 16)	N. Suresh Kumar, Sc.-C
9.	PIP-3469	Screening of early sprouters and late senescence mulberry variety with better leaf yield and quality under low temperature condition (Nov., 11 to Oct., 14)	A. K. Misra, Sc.-C



10.	AIP-3472	Standardization and determination of temperature tolerance potentiality in different developmental stages of silkworm , <i>Bombyx mori</i> L. (Sept., 11 to Aug., 14)	A.K. Saha, Sc.- D
11.	AIE- 3454	Evaluation of elite bivoltine silkworm germplasm under different agro climatic conditions: All India Silkworm Germplasm Evaluation Programme Phase-II". (Sept., 11 to Aug., 14)	M. K. Singh, Sc.-C
12.	AIB 3496	Development of high temperature and high humidity tolerant bivoltine breeds of silkworm (<i>Bombyx mori</i> L.(June.,12 to May., 15)	N.Suresh Kumar,Sc-C
13.	AIB 3480	Development of silkworm of silkworm (<i>Bombyx mori</i> L) breeds from a gene pool with higher genetic plasticity. (Sept., 12 to Aug., 16)	G. K. Chattopadhyay, Sc.-C
14.	CSS-2107	Forewarning of Mulberry diseases of Eastern and North Eastern India.(Sept., 12 to Aug., 17)	S .K. Datta, Sc.-C
15.	AIB 3491	Post Authorization Trials of Silkworm Hybrids in Eastern & North-Eastern India.(Sept., 12 to Dec., 14)	N. Suresh Kumar, Sc-C
16.	PIB- 3479	Development of high yielding mulberry varieties using physiological growth parameters as markers for selection. (Oct., 12 to Sept., 16)	Jalaja S. Kumar, Sc-C
17.	PPF 3487	Decision support system initiative through impact assessment of agro-climate on foliage yield of mulberry (<i>Morus</i> sp) for climate resilient sericulture in Eastern India.(Oct., 12 to Sept., 13)	Monica Choudhuri, Sc-C
18.	PIB 3481	Evaluation of mulberry varieties suitable for low in put soils (Jan., 13 to Dec., 17).	M.K. Ghosh, Sc-D
19.	DST	Improvement of mulberry seed cocoon production at farmers' level with special reference to bivoltine seed cocoon in West Bengal. (Nov., 11 to Oct., 12). (CONCLUDED)	T. Datta (Biswas), Sc.-C



Pilot Study: 2

Sl. No.	CODE No.	TITLE	PI
20	BAR(PS) - 002	Formulation of broad spectrum room disinfectant for silkworm disease management. (Aug., 11 to July,13)	S. Chakraborty, Sc-B
21	BPP(PS)- 001	Improvement of mulberry through <i>in vitro</i> mutagenesis and somaclonal variation. (July,11 to Dec.,12)	N. Lalitha, Sc-B

Programmes: 30

Sl. No.	CODE No.	TITLE	PI of the Project
22	BPR (P) 021	Development of weather based forecasting models for mulberry pests. (Collaboration with 3 RSRs & 2 RECs) (Apr., 05 to Dec., 10; Extn. up to Dec., 15)	S. K. Mukhopadhyay, Sc-C
23	BPP(P) 020	Evaluation of soil fertility for sustained production of quality mulberry leaf in Eastern India under long-term fertilization. (Jul., 05 to Jun., 10; Extn. up to Dec., 15)	R. Kar, Sc-C
24	AICEM (Ph-III)	All India Coordinated Experimental Trail for Mulberry (AICEM)- Phase III, (A prog. of C.O., Bangalore) (April, 11 to June, 15)	M. K. Ghosh, Sc-D
25	BPP (RP) 001	Production of Azotobacter (<i>Nitrofert.</i>). Continuous	S. Rajaram, Sc-C
26	BPP (RP) 002	Production VA- Mycorrhiza (<i>Phosphofert</i>) Continuous	S. Rajaram, Sc-C
27	BPR (VP) 006	Studies on the field efficacy of selected dose of insecticide in whitefly management (July, 11 to June, 13)	M. V. Santha Kumar, Sc-C
28	B-RNC (VP) 007	Validation trial of package of nutrient under rainfed condition (RSRS, Ranchi) (Oct.,11 to Oct.,13)	Ghanshyam Singh, Sci.-C
29	BAI(P) 008	Screening and identification of bivoltine breeds for Eastern and North-Eastern India. (Aug.,11 to Mar., 13) Extended 1 year upto Mar.,13	N. Suresh Kumar, Sc-C



30	B-KPG (P) 006	Muga seed multiplication prog.: Raising of Muga host plantation at RSRS-Annex, Kalimpong (As per the Central Office Letter no.:CSB-65/1/2004-05/TS-4/ Dated 16-10-09.). (2009 to 2014)	M. D. Maji, Sc-C (RSRS, Kalimpong)
31	BAI(P) 007	Establishment of molecular IDs for the mulberry silkworm breeds (<i>Bombyx mori</i>) evolved by CSR&TI, Berhampore (Jul., 11 to Jun., 13)	S. Sree Kumar, Sc-C
32	BPP(VP) 008	Field evaluation of plant growth regulator combination for improvement of quality leaf yield of mulberry especially under cold stress condition (Dec., 11 to Nov., 12) Extended 1 year upto Nov., 13.	P.K. Tewary, Sc- C
33	BAI(P) 014	Studies on the reelability of multivoltine hybrid cocoons during adverse climatic conditions in Eastern & North-Eastern region. (July, 11 to March, 14)	N.B. Kar, Sc- C
34	B-KPT(P) 017	Assessment of fertility status of mulberry growing soils in selected Seri-village of Koraput for appropriate fertilizer management. (Jan., 12 to Dec., 13)	S.K. Mishro, Sc.-C
35	B-RNC(P) 018	Assessment of fertility status of mulberry growing soils in selected Seri-village of Ranchi for appropriate fertilizer management. (Jan., 12 to Dec., 13)	Ghanshyam Singh, Sc.-C
36	B-JRH(P) 019	Assessment of fertility status of mulberry growing soils in selected Seri-village of Jorhat for appropriate fertilizer management. (Jan., 12 to Dec., 13)	S. N. Gogoi, Sc.-C, RSRS, Jorhat.
37	B-KPG(P) 015	Improvement of rearing technology for autumn crop in Sub-Himalayan region. (Aug., 12 to Jan., 14)	R. Bhutia, Sc-C, RSRS Kalimpong
38	BPP(VP) 003	Validation Trail on the superiority of paired row plantation in chawki mulberry garden with regard to leaf yield and cocoon productivity. (Oct., 10 to Sept., 12) (CONCLUDED)	T. Datta (Biswas), Sc.-C
39	BAR(VP) 005	Study on the efficacy of newly developed bed disinfectant (Sericillin) in hot spot areas for the control of muscardine disease of silkworm, <i>Bombyx mori</i> L. (Aug.,10 to July, 12) (CONCLUDED)	S. Chakraborty, Sc-B



40	BAI(P) 010	Popularization of authorized silkworm (<i>Bombyx mori</i> L.) hybrids (Sept.,10 to Aug.,12) (CONCLUDED)	G. K. Chattopadhyay, Sc-C
41	B-RNC(RP)-004	Survey and surveillance of disease and pest of mulberry and silkworm. (April, 2011 to March, 2013). (Routine activity) [CONCLUDED]	A. H. Naqvi, Sc-C
42	Prog.	Survey and surveillance of disease and pest of mulberry and silkworm. (April, 2011 to March, 2013). (Routine activity) [RSRS, Koraput] [CONCLUDED]	R. Sahu, Sc-C
43	BAR(RP) 005	Survey and surveillance of silkworm diseases in the traditional sericultural districts of West Bengal. (Continuous) [CONCLUDED]	S. Chakrabarty, Sc-C
44	MSRAP Phase-VIII	MSRAP Phase-VIII programme. (Jan., 2011 to Dec., 2012). [A Prog. of C.O. Bangalore]) [CONCLUDED]	H. Lakshmi, Sc-B
45	BAI(RP) 003	Maintenance of bivoltine and multivoltine germplasm and newly developed breeds and their lines. (April, 2012 to March, 2013). (Continuous) [CONCLUDED]	S. Mukherjee, Sc-C
46	BAI(P) 009	Field level testing of New hybrids. (Jan., 11 to Dec., 12) (CONCLUDED)	H. Lakshmi, Sc-B
47	BPP(P) 012	Studies on reduction in cost of production and improvement on crop productivity for sustainable sericulture under West Bengal conditions (Sept., 11 to Feb., 13) Concluded in Dec., 2012. (CONCLUDED)	S. Rajaram, Sc-C
48	BAR(P) 013	Studies on the identification of the casual agent symptomatic of Gattine like disease in silkworm <i>Bombyx mori</i> L. (Jan., 12 to Dec., 12) (CONCLUDED)	Zakir Hossain, Sc-C
49	B-KPG (P) 016	Assessment of fertility status of soils of RSRS farm and progressive farmers' fields in selected seri. villages of Kalimpong to increase the yield and quality of mulberry (<i>Morus spp</i>) leaves. (Oct.,11 to Dec.,12) (CONCLUDED)	R.L. Ram, Sc.-C, RSRS, Kalimpong
50	BMO(P) 003	Institute Village Linkage Programme (IVLP) - Phase III. (Collaboration with 4 RSRSs) (April, 10 to March, 13) (CONCLUDED)	D. Das, Sc-C
51	B-JRH(P) 011	Studies on the biology and feeding efficiency of the coccinellid predator, <i>Scymnus</i> sp. for management of whitefly on mulberry). (RSRS, Jorhat) (April, 11 to March, 13) (CONCLUDED)	Y. Debraj, Sc-C



11. CONSULTANCY & OTHER SERVICES RENDERED

Product/ technology commercialized: The product ‘Sericillin’ has been commercialized through NRDC, New Delhi based on an Agreement Deed executed between this Institute and the former on 06.02.13. Two entrepreneurs have obtained license from NRDC, New Delhi.

A) Consultancy:

Facility	Location of facility	Areas (Acres)	Beneficiaries (Nos)
Testing laboratory	RSRS, Koraput RSRS, Kalimpong	30 acres* 8 acres**	30 farmers 16 farmers

*Villages: Bayaput, Sagar, Sukriguda, Ratapoda, Siriguda, Bhagamoda and Khurigaon.

**Villages: Kharkabusti, Bhalukhop, Mahakaldara, Dolapchand, Sangsay, Khani, Gitbabling and Saurani.

B) Royalty:

Sl. No.	Year	Letter No.	Premia (Rs.)	Royalty (Rs.)
1.	01.04.2012 to 31.03.2013	2085 Dated 14/5/12		2526.00
2.	01.04.2012 to 31.03.2013	706 Dated 17/5/12		1324.00
3.	01.04.2012 to 31.03.2013	6083 Dated 31/7/12	1348.00	
4.	01.04.2012 to 31.03.2013	1837 Dated 9/8/12		33000.00
5.	01.04.2012 to 31.03.2013	2918 Dated 6/11/12		1348.00
6.	01.04.2012 to 31.03.2013	11937 Dated 7/12/12	20500.00	
7.	01.04.2012 to 31.03.2013	12635 Dated 20/12/12	70900.00	
		Total	92748.00	38198.00

C) Right to information Act, 2005:

Sl. No.	Date of request	Compliance
1	16.02.2012	CSB/CSR&TI/RTI-86/2012-13/961 dated 28.04.2012
2	12.04.2012	CSB/CSR&TI/RTI-86/2012-13/2503 dated 28.05.2012
3	05.05.2012	CSB/CSR&TI/RTI-86/2012-13/2049 dated 14.05.2012
4	15.06.2012	CSB/CSR&TI/RTI-86/2012-13/4195 dated 07.07.2012
5	16.07.2012	CSB/CSR&TI/RTI-86/2012-13/9230 dated 05.10.2012
6	14.08.2012	CSB/CSR&TI/RTI-86/2012-13/7623 dated 28.08.2012



12. INSTITUTE RAC /RC /RRACs: MAJOR SCIENTIFIC RECOMMENDATIONS

Sl. No.	Meetings / Workshop	Date
1.	Research Advisory Committee (RAC)	25 th - 26 th June, 2012 (36 th) 10 th - 11 th Dec., 2012 (37 th)
2.	Research Council (RC)	31 st July, 2012; 26 th Feb., 2013
3.	Extension Officers' Meeting	1 st August, 2012; 27 th Feb., 2013
4.	Regional Research Advisory Committee (RRAC)	10.09.2012 (Kalimpong, West Bengal) 27.09.2012 (Koraput, Odisha) 22.01.2013 (Jorhat, Assam) 06.02.2013 (Ranchi, Jharkhand)

Major Recommendations:

Research Advisory Committee:

(i) 36th meeting held on 25th & 26th June, 2012.

- ☞ More number of demonstration prog. need to be taken up with the stakeholders.
- ☞ Development of high temperature and humidity tolerant silkworm breeds, suitable for the region as well as cold tolerant mulberry varieties.
- ☞ More clusters to take up in coordination with the DoT(Seri)/ DoS.

(ii) 37th meeting held on 10th & 11th Dec., 2012.

- ☞ Development of season and region specific silkworm breeds/ hybrids. Survey in the non-traditional areas of Odisha for exploring sericulture for the stakeholders.
- ☞ Scientists working at RSRs/ RECs in coordination with the DoT (Seri)/ DoS to meet the need for region specific requirements.



- ☞ To have easy accessibility of the farmers with the Extension workers working IVRS and broadcasting of extension prog. on AIR and TV need to be explored.

Research Council:

(i) 37th meeting held on 31st July, 2012.

1. RSRS, Jorhat to increase the rearing capacity at farmers' level for the trial of SK6 x SK7 bivoltine foundation cross. For supply the dfls to the farmers, indent of dfls should be obtained from the concerned DoT / DoSs.
2. RFD should be out-put oriented and effort should be made to achieve the maximum target set under ToT and training to the beneficiaries.
3. Efforts should be made for effective absorption of technology into the field.
4. Formation of Disease Monitoring Committee at Institute/ RSRSs level by including the officers of State and NSSO. The Bio-data of the Scientists of Extension units to be uploaded at the Institutes' website.

(ii) 38th meeting held on 26th Feb., 2013.

1. For maintenance of mulberry and silkworm germplasm, the RSRSs and the Silkworm and Mulberry Breeding & Genetics Sections of the Institute should take up the programme separately and obtain Code No.
2. Scientists should meticulously review the literature while preparing the projects/ prog. and shall append an undertaking with the proposal that literature includes latest and updated citations/ references.
3. The RSRSs to develop their own database enabling to upload the same on the website.
4. The PI of the Projects/ Prog. to maintain the Project Registers with expenditure details.
5. RSRSs to constitute Disease Monitoring Committee by including officers/ officials of DoT/ DoS and NSSO to conduct the disease survey & surveillance as per the annual event calendar.



Regional Research Advisory Committee:

A) RSRS, KORAPUT: Meeting held on 27th Sept., 2012 at Regional Office, CSB, Bhubaneswar (Odisha).

- ☞ For promotion of Bivoltine seed cocoon generation programme, the RSRS Koraput and its nested units along with DoS, Odisha should give more emphasis on making the seed crop successful for a better return to the farmers.
- ☞ RSRS Koraput to formulate a project/programme with higher spacing i.e. 6' x 6', 8' x 8' and 10' x 10' as high bush/tree type plantation.

B. RSRS, KALIMPONG: Meeting held on 10th Sept., 2012 at RSRS, Kalimpong, West Bengal.

- ☞ Inclusion of Siliguri as an additional operational area of RSRS, Kalimpong. Initially 20-25 progressive farmers from 2-3 villages may be taken up for initiating Extension and related programmes, for dissemination of proven technologies.
- ☞ DoS, Sikkim to increase the subsidy for construction of rearing house and also to raise the purchase price of bivoltine seed cocoons for a better return to the farmers.
- ☞ RSRS, Kalimpong to create the facility for production of bio-fertilizers and will supply the bio-fertilizers for the use at farmers' field,

C. RSRS, JORHAT: Meeting held on 22nd January, 2013 at NBSS & LUB, Jorhat, Assam.

- ☞ The scientists to formulate collaborative projects with NBSS and LUP to be funded by CSB.
- ☞ REC, Shillong to elevate to a full fledged Satellite Breeding Station for Bivoltine Sericulture.

D. RSRS, RANCHI: Meeting held on 6th February, 2013 at Indian Council of Forestry Research & Education, Lalgitwa, Ranchi, Jharkhand.

- ☞ RSRS, Ranchi to take up new need based project suited to rainfed conditions to Jharkhand.
- ☞ Consider the impact of technologies during implementation of projects/programme at farmers' level.



13. PARTICIPATION OF SCIENTISTS IN WORKSHOP / SEMINAR/ SYMPOSIUM/ CONFERENCE

13.A. International

13.A.1. Abroad

Sl. No.	Workshop / Seminar/ Symposium/ Conference	Period	Scientists
1.	International Conference on Wild Silk Moth and Silk at Mahasarkhan Province, Thailand.	22 nd to 24 th Nov., 2012	L. Pachuau, Sci-C

13. A.2. In the country

1.	International symposium on food security dilemma: Climate change and plant health issues' AAPP, BCKV, Kalyani, West Bengal, India.	7 th to 9 th Dec., 2012.	Manoja Patnailk, Sci-C
2.	International conference on Global meet of biologists, Indian Institute of Chemical Technology, Hyderabad.	26 th to 28 th Dec., 2012.	Jalaja, S. Kumar., and N. Suresh Kumar, Sci-C
3.	Indian Social Science Congress organized by Indian Academy of Social Sciences at Bhubaneswar.	27 th to 31 st Dec., 2012	N. K. Das, Scientist-C
4.	International Conference on Insect Science at University of Agricultural Sciences, Bangalore.	14 th to 17 th Feb., 2013.	M. V. Santha Kumar, Sci-C
5.	General Management Programme for Woman Scientists Administrative Staff College of India, Hyderabad, India	4 th to 15 th March, 2013	Smt C. Maji, Sci-C

13.B.1. National

1.	National Seminar on Silkworm breeder's meet held at CSB, Bangalore.	28 th to 29 th May, 2012.	B. B. Bindroo, Director
2.	National Symposium on Plant Microbe Interactions and Crop Health Management at Visva Bharati, Dept. of Plant Protection, Palli-Siksha Bhavana (Institute of Agri-culture), Sriniketan.	6 th to 7 th Oct., 2012	S. Chatterjee, Sci.-C and S. Chakrabarty, Sci-B



3.	International Conference on Anthropogenic Impact on the Environment and Bioremediation at Department of Biosciences, St. Xavier's College, Ranchi in collaboration with National Environmentalists Association, India, Ranchi, Jharkhand.	2 nd to 4 th Nov., 2012	C. Maji, Sci-D
4.	National Symposium on Blending Conventional and Modern Plant Pathology for Sustainable Agriculture at Indian Institute of Horticultural Research, Bangalore.	4 th to 6 th Dec., 2012	M. D. Maji, Sci-C
5.	National Seminar on "Recent Advances in Life Science application" – Organized by Post Graduate Department of Zoology, Acharya B.N. Seal College, Cooch Behar in Collaboration with Department of Agricultural Entomology, UBKV, Pundibari, Cooch Behar, West Bengal.	8 th to 9 th Dec., 2012	S. K. Dutta, Sci-C
6.	Centenary Session of Indian Science Congress in Agriculture and Forestry Sciences at University of Calcutta, Kolkata.	3 rd to 7 th , Jan., 2013.	S. Roy Chowdhuri, Sci-D, A. K. Saha, Sci-D, R. Kar, Sci-C, D. Das, Sci-C, T. Datta (Biswas), Sci-C, S. K. Mukhopadhyay, Sci-C, M. V. Santha Kumar, Sci-C, A. K. Verma, Sci-C, S. Chakrabarty, Sci-B, N. Lalitha, Sci-B.
7.	National Symposium on Recent Trends in Plant and Microbial Research at Department of Botany, University of North Bengal.	22 nd to 23 rd March, 2013	M. D. Maji, Sci-C



14. WORKSHOPS / SEMINARS / SUMMER INSTITUTES/ RKM AND FARMERS'DAYS ORGANIZED

14.A. Resham Krishi Mela organized by CSR&TI, Berhampore at Malda (W.B.)

The Resham Krishi Mela was organized by CSR&TI, Berhampore at Durga Kinkar Sadan (Malda College Auditorium), Malda on 10th January, 2013. Shri K. N. Chowdhury, Hon'ble Minister in charge, Tourism, Govt. of West Bengal &



Chairman, English Bazar Municipality was the Chief Guest of the Mela. Other honourable dignitaries were Shri A. N. Khan Chowdhury, MLA, Sujapur, Shri Ujjal Chowdhury, Chairman, Malda Zilla Parishad, Shri Pravas Chowdhury, Principal, Malda College, Shri A. N. Mondal, Joint Director of Textiles (Seri), North Zone, Govt. of West Bengal and Dr. B. B. Bindroo,

Director, CSR&TI, Berhampore. Dr. B. B. Bindroo addressed the gathering and reminded about the past glory of Bengals Sericulture on his speech and also indicated the lion's share of states silk production of Malda. He stressed on the generation of P1 Bivoltine seed cocoons for improvement in productivity.

14. B. Workshops organized by CSR&TI, Berhampore(W.B.)

To get an assessment of the achievements in quality Bivoltine seed cocoons production, through technology intervention by the stakeholders, CSR&TI,



Berhampore organized a workshop on 18^h October, 2012 on the aspect covering *“Improvement of Mulberry Seed Cocoon Production at Farmers' level with special reference to Bivoltine Seed Cocoon in West Bengal”*, a project funded by DST, Govt. of West Bengal. Dr. B. B. Bindroo, Director, CSR & TI, Berhampore presided over the workshop while Mr. B. K. Mukherjee, Addl

Director of Textiles (Seri), Govt. of West Bengal was the chief guest. Joint Director and Deputy Directors of Textiles (Seri), Kolkata, Malda, Murshidabad, Nadia and Birbhum districts of West Bengal, Mr. R. Bhattacharya, Jt. Sec (Tech), RO, Kolkata, Dr. K. Mandal, Sci.-D, ZSSO, Malda and Dr. N. B. Pal, Sci.-C and Incharge, SSPC, Berhampore also participated in the workshop. A workshop Manual and Crop Schedule brochure were also released.

14. C. Awareness Programme organized by CSR&TI, Berhampore at Banjetia village:

An awareness programme was organized at Banjetia village of Murshidabad district on 22nd Sept., 2012 with the farmers of Banjetia and Kalitala Diar villages under the DST, Govt. of West Bengal, Kolkata funded Project “Improvement of Mulberry Seed Cocoon Production at Farmers’ Level with Special Reference to Bivoltine Seed Cocoon in West Bengal” to aware the farmers about the precautionary measures to be taken during the Agrahayani seed crop which is characterized with high temperature coupled with high humidity. Twenty five farmers from two villages participated in the awareness programme, to whom, rearing appliances were distributed. Md. S. Khan, E.O., DOT (Seri), Govt. of West Bengal, Murshidabad and Dr. N. B. Pal, Sci.-C, SSPC, Berhampore participated in the awareness programme.



14.D.Workshop organized by DOS at Champak Nagar, Agartala:

On 2nd October, 2012 a workshop was organized by DoS at Champaknagar cluster. Hon’ble Minister Mr. Jitendra Chowdhury inaugurated the seminar by lightening the lamp. Shri S. P. Bhomik, Cluster in charge welcomes all the guest and farmers. Shri Tushar Kant Chakma, IAS briefed the farmers about different developmental activities going on in the state and he requested the farmers to take the benefits of different schemes.



14. E.Resham Krishi Mela organized by REC Aizawl & DOS Mizoram:

The Mela was attended by Shri Nihar Kanti Chakma, Minister of Sericulture, Veterinary Department and Disaster Management & Rehabilitation, Shri Lalthankhuma, MCS, Secretary of Sericulture, Govt. of Mizoram, D. Engzananga, Director of Sericulture, Govt. of Mizoram, Dr. B. B. Bindoo, Director, CSR&TI, Berhampore and Smt. Lalitlanpuui a private entrepreneurs along with Scientists, officers and officials of RSRS Jorhat, REC Aizawl and DoS Mizoram. Altogether 200 farmers attended the Mela. An exhibition was organized to display the various technology developed by CSB for benefit of farmers.



15. LIST OF VISITORS/ DIGNITARIES WHO VISITED THE INSTITUTE

15.A. MAIN INSTITUTE

Sl. No.	Visitors / dignitaries	Address	Date of visit
1.	Shri Jayanta Koley	Judge, Special Court, Berhampore, Murshidabad.	08.05.2012
2.	Prof. A. K. Banerjee	Vice-Chancellor, University of Kalyani, Nadia, West Bengal.	05.01.2013
3.	Dr. S. M. H. Qadri.	Director, CSR & TI, Mysore.	02.03.2013

15.B. RSRs, KALIMPONG, WEST BENGAL:



With a view to motivate the farmers' on different agriculture developmental aspects, a Sabala Mela was organized by the District Authority, Darjeeling during 25.04.2012 to 01.05.2012 at Kalimpong hills. In this occasion, Shri Goutam Deb, Hon'ble Minister of North Bengal Development, visited the exhibition stall of RSRs, Kalimpong in the Mela. Scientists of RSRs, Kalimpong demonstrated various technologies to the visiting delegates.

15.C. REC, SHILLONG, MEGHALAYA:

A team from GIZ Project, Germany visited REC, Shillong, Meghalaya, on 15th October, 2012. The distinguished visitors interacted with the scientist of REC, Shillong on various aspects of sericulture and its potential in the state. They were impressed upon the mulberry cultivation and silkworm managements at farmers' level.



राजभाषा अधिनियम, 1963 के अन्तर्गत राजभाषा नीति का सम्यक अनुपालन किया गया। राजभाषा अधिनियम की धारा -3 (3) एवं राजभाषा नियम -5 जैसे अनिवार्य प्रावधानों का शत-प्रतिशत अनुपालन सुनिश्चित किया गया है। राजभाषा हिन्दी के अन्य महत्वपूर्ण कार्यान्वयन बिन्दुओं / प्रावधानों पर भी कार्रवाई की गई। संस्थान में राजभाषा कार्यान्वयन समिति की बैठक का आयोजन कर राजभाषा प्रगति / कमियों की समय-समय पर समीक्षा, हिन्दी कार्यशाला , हिन्दी पखवाड़ा/दिवस, हिन्दी भाषा प्रशिक्षण, हिन्दी पुस्तक/पुस्तिकाओं का संपादन, हिन्दी प्रतियोगिता का आयोजन एवं प्रोत्साहन योजनाओं का कार्यान्वयन किया गया। फलस्वरूप, संघ की राजभाषा नीति के उत्कृष्ट कार्यान्वयन तथा राजभाषा हिंदी के प्रगामी प्रयोग में सराहनीय योगदान के लिए इस संस्थान को राजभाषा संस्थान, नई दिल्ली द्वारा दिनांक 27.4.2012 को “कार्यालय दीप स्मृति चिह्न” से सम्मानित किया गया।

(‘É’ÉÇ 2012-13)

Raj Bhasha Anubhag Ki Gatibidhian

केन्द्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, बहरमपुर (प.बं.) में वर्ष 2012-13 के दौरान संघ की राजभाषा नीति का सम्यक अनुपालन किया गया। राजभाषा अधिनियम की धारा -3 (3) एवं राजभाषा नियम -5 जैसे अनिवार्य प्रावधानों का शत-प्रतिशत अनुपालन सुनिश्चित किया गया है। राजभाषा हिन्दी के अन्य महत्वपूर्ण कार्यान्वयन बिन्दुओं / प्रावधानों पर भी कार्रवाई की गई। संस्थान में राजभाषा कार्यान्वयन समिति की बैठक का आयोजन कर राजभाषा प्रगति / कमियों की समय-समय पर समीक्षा, हिन्दी कार्यशाला , हिन्दी पखवाड़ा/दिवस, हिन्दी भाषा प्रशिक्षण, हिन्दी पुस्तक/पुस्तिकाओं का संपादन, हिन्दी प्रतियोगिता का आयोजन एवं प्रोत्साहन योजनाओं का कार्यान्वयन किया गया। फलस्वरूप, संघ की राजभाषा नीति के उत्कृष्ट कार्यान्वयन तथा राजभाषा हिंदी के प्रगामी प्रयोग में सराहनीय योगदान के लिए इस संस्थान को राजभाषा संस्थान, नई दिल्ली द्वारा दिनांक 27.4.2012 को “कार्यालय दीप स्मृति चिह्न” से सम्मानित किया गया।

संस्थान द्वारा आलोच्य अवधि के दौरान विभिन्न कार्यान्वयन बिन्दुओं पर की गई कार्रवाई का ब्यौरा निम्नवत है :

1. धारा-3(3) का अनुपालन :

राजभाषा अधिनियम की धारा- 3(3) के अन्तर्गत आने वाले सभी कागजात यथा सामान्य आदेश, निविदा, नियम, सूचना, अधिसूचना एवं संविदा करार विज्ञप्ति तथा प्रशासनिक एवं अन्य रिपोर्ट प्रतिवेदन इत्यादि को द्विभाषी में जारी किया गया।

2. हिन्दी पत्राचार :

वर्ष के दौरान ‘क’, ‘ख’ एवं ‘ग’ क्षेत्र में स्थित केन्द्र / राज्य सरकार को क्रमशः 83.91% , 85.36% तथा ‘ग’ क्षेत्र में स्थित केन्द्रीय सरकार के कार्यालयों को 79.44% पत्र हिन्दी में भेजे गए। इस प्रकार पत्राचार के मद में लक्ष्य से अधिक पत्राचार किया गया।

3. हिन्दी प्रशिक्षण :



आलोच्य अवधि के दौरान अधिकारियों /कर्मचारियों को हिन्दी शिक्षण के योजना के अधीन प्रशिक्षण कार्य जारी है। इस दौरान संस्थान के कुल 11 पदधारी हिंदी परीक्षा में उत्तीर्ण हुए हैं। अब तक संस्थान के कुल 95.45% अधिकारी/ कर्मचारी इस योजना के अन्तर्गत प्रशिक्षित किये जा चुके हैं तथा वर्तमान सत्र (जुलाई, 2013 - मई, 2014) के दौरान 7 पदधारी उक्त योजना के अधीन विभिन्न पाठ्यक्रम के अधीन प्रशिक्षणाधीन हैं।

4. राजभाषा कार्यान्वयन समिति की बैठको का आयोजन :

राजभाषा नियम/अधिनियम के प्रावधानों के सम्यक अनुपालन एवं समय-समय पर राजभाषा कार्यों की प्रगति /कमियों की समीक्षा हेतु संस्थान में प्रत्येक तिमाही के दौरान विभागीय राजभाषा कार्यान्वयन समिति की बैठकों का आयोजन कर कार्यान्वयन की दिशा में आने वाली कठिनाइयों का निदान किया जाता है। वर्तमान वर्ष 2012-13 के अंतर्गत राजभाषा कार्यान्वयन समिति की चार बैठकों का आयोजन क्रमशः दिनांक 30.06.12, 29.09.12, 21.12.12 एवं 18.03.2013 को किया गया तथा बैठक में लिए गए निणयों पर अनुवर्ती कारवाई की गई। इसके अतिरिक्त, संस्थान के अधीनस्थ केन्द्रों में राजभाषा हिंदी के कार्यान्वयन की दिशा में की जा रही कार्रवाई/प्रगति की समीक्षा व मूल्यांकन करने की दृष्टि से संस्थान के अधीनस्थ केन्द्रों की संयुक्त राजभाषा कार्यान्वयन समिति की 27वीं एवं 28वीं बैठक क्रमशः दिनांक 02.08.12, तथा 27.02.13, को इस संस्थान में आयोजित कर केन्द्रों में की जा रही कार्रवाई व प्रगति की समीक्षा की गई।

5. हिन्दी कार्यशाला का आयोजन :

संस्थान में कार्यरत अधिकारियों/कर्मचारियों को हिन्दी में कामकाज करने में सुगमता हेतु प्रत्येक वर्ष हिन्दी कार्यशाला का आयोजन किया जाता है। कार्यशाला का आयोजन कर्मचारियों की कार्य प्रकृति के अनुसार अलग-अलग समूहों में किया जाता है। तकनीकी तथा प्रशासनिक संवर्ग के कर्मचारियों के अलावा अधिकारियों के लिए दिनांक 26.07.12, 15.12.12, तथा 23.02.13 को हिंदी कार्यशाला आयोजित कर संस्थान के कुल 87 पदधारीगण राजभाषा हिन्दी में प्रशिक्षित किए गए तथा आगे भी यह क्रम जारी है।

6. अधीनस्थ कार्यालयों / केन्द्रीय रेशम बोर्ड के अन्य कार्यालयों आंबटित कार्यालयों में हिन्दी कार्यशाला :

संस्थान की संबद्ध इकाइयों में भी संघ की राजभाषा नीति के सफल कार्यान्वयन हेतु हिन्दी कार्यशालाओं का आयोजन किया जाता है। इस क्रम में क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्र, कोरापुट, कलिम्पोंग, रांची, जोरहाट तथा अनुसंधान प्रसार केन्द्र, नबाग्राम, रंगपो,



ईम्फाल, शिलांग, आईजोल, दीमापुर के अतिरिक्त क्षेत्रीय कार्यालय, कोलकाता में भी पूर्ण दिवसीय हिन्दी कार्यशालाओं का आयोजन किया गया।

7. राजभाषा प्रोत्साहन योजना का कार्यान्वयन :

संस्थान एवं इसके संबद्ध/अधीनस्थ केन्द्रों में कार्यरत अधिकारियों तथा कर्मचारियों में राजभाषा हिन्दी के प्रति अभिरुचि जगाने हेतु समय समय पर विभिन्न राजभाषा कार्यक्रम/प्रतियोगिता का आयोजन किया जाता है। इन कार्यक्रमों द्वारा कर्मचारियों को प्रोत्साहित/पुरस्कृत करने के अलावा हिन्दी में मूल रूप से टिप्पण आलेखन करने वाले अधिकारियों/कर्मचारियों के लिए केन्द्रीय रेशम बोर्ड की उदारीकृत प्रोत्साहन योजना को भी लागू किया गया है जिसके अर्न्तगत निर्धारित शब्द संख्या हिन्दी में लिखने पर अनुपातत : नगद प्रोत्साहन राशि (अधिकतम रु 1000.00) प्रदान की जाती है।

8. हिन्दी पुस्तक/पुस्तिकाओं का प्रकाशन :

संघ की राजभाषा नीति के अनुसार संस्थान में अंग्रेजी प्रकाशनों के अनुरूप वैज्ञानिक एवं तकनीकी/प्रशासनिक प्रकाशनों का हिन्दी रूपांतरण भी आवश्यकतानुसार प्रकाशित किया जाता है। वर्तमान वर्ष के अर्न्तगत संस्थान की वार्षिक वैज्ञानिक एवं प्रशासनिक रिपोर्ट वर्ष 2011-12 के सारांश प्रकाशित करने के अतिरिक्त राजभाषा हिन्दी को समर्पित पत्रिका “रेशम दर्शन”, दिसंबर, 2012 तथा न्यूज एंड व्यूज (जुलाई, 2012 एवं दिसम्बर, 2012) अंकों का हिन्दी संस्करण का प्रकाशन किया गया।

9. नगर राजभाषा कार्यान्वयन समिति का गठन एवं उसकी बैठकों का आयोजन :

वर्ष 1997-98 के शुरुआत में ही राजभाषा विभाग, भारत सरकार, नई दिल्ली द्वारा संस्थान के निदेशक को अध्यक्ष के रूप में नगर राजभाषा कार्यान्वयन समिति के गठन, बैठकों के नियमित आयोजना तथा बहरमपुर नगर स्थित केन्द्रीय सरकार के कार्यालयों/बैंकों/निगमों/उपक्रमों/संगठनों आदि में संघ की राजभाषा नीति के सफल कार्यान्वयन का अतिरिक्त दायित्व निहित किया गया। वर्ष के दौरान समिति की 26वीं बैठक दिनांक 11.05.2012 तथा दिनांक 04.02.2013 को 27वीं बैठक संपन्न की गई। समिति के प्रयास से नगर स्थित केन्द्रीय सरकार के कार्यालयों/बैंकों/निगमों/उपक्रमों/संगठनों आदि में भी राजभाषा गतिविधियां बढ़ी हैं। फलस्वरूप, विगत वर्ष के दौरान नगर राजभाषा कार्यान्वयन समिति, बहरमपुर को भारत के पूर्वी तथा पूर्वोत्तर क्षेत्र के राज्यों में तृतीय स्थान से सम्मानित होने का सुअवसर प्राप्त हुआ है। इसके अतिरिक्त, नगर के सदस्य कार्यालय अपने-अपने कार्यालयों में हिन्दी दिवस, प्रतियोगिता, संगोष्ठी कार्यशाला एवं बैठकों का आयोजन कर रहे हैं। समिति



की उक्त गतिविधियों के संचालन से संस्थान में राजभाषा कार्यान्वयन संबंधी कार्यमात्रा में भी अत्यधिक वृद्धि हुई है।

10. राजभाषा नियम 10 (4) के अन्तर्गत अधीनस्थ कार्यालयों को अधिसूचित किया जाना:

संस्थान के सम्बद्ध / अधीनस्थ केन्द्रों में कार्यरत 80 % कर्मचारियों को हिन्दी प्रशिक्षण दिलाने के पश्चात् ऐसे कार्यालयों को मंत्रालय द्वारा राजभाषा नियम -10(4) के अधीन अधिसूचित करने की कार्यवाही की जाती है। इस क्रम में संस्थान के 09 अधीनस्थ कार्यालयों को अधिसूचित कराया जा चुका है।

10. हिन्दी प्रतियोगिता का आयोजन :

वर्ष 2012-13 के दौरान दिनांक 01.09.12 से 14.09.12 तक आयोजित हिन्दी पखवाड़ा के अन्तर्गत विभिन्न हिन्दी प्रतियोगिता का आयोजन किया गया। इन प्रतियोगिता में संस्थान के अधिकारियों/कर्मचारियों ने उत्साह से भाग लिया। इस दौरान कुल 08 हिन्दी प्रतियोगिताओं क्रमशः टिप्पण व आलेखन 01.09.12, शब्दावली 3.09.12, निबन्ध 04.09.12, वाद-विवाद 05.09.12, सुलेख व श्रुतलेख 06.09.12, राजभाषा प्रश्नोत्तरी 07.09.12, अंत्याक्षरी 1 0.09.12, तात्क्षणिक भाषण 11.09.12 का आयोजन किया गया। प्रत्येक प्रतियोगिता के सर्वश्रेष्ठ प्रतिभागियों को प्रथम, द्वितीय, तृतीय एवं सात्वना पुरस्कार से पुरस्कृत किए गए।

11. कम्प्यूटर पर हिन्दी में कार्य :

राजभाषा अधिनियम-1963 की धारा 3-(3) का अनुपालन, फार्म/प्रपत्र का द्विभाषीकरण, सम्बद्ध/ अधीनस्थ केन्द्रों की तिमाही रिपोर्ट का समेकीकरण एवं अनुभागीय प्रगति रिपोर्ट के तुलनात्मक विवरण आदि के संकलन एवं पत्रिका के प्रकाशन/संपादन का कार्य तथा नगर राजभाषा कार्यान्वयन समिति की गतिविधियों संबंधी कार्य को कम्प्यूटर पर सुचारु रूप से किया जा रहा है। राजभाषा कार्यान्वयन के विभिन्न पहलुओं में कम्प्यूटर के प्रयोग की शुरुआत से राजभाषा कार्यान्वयन के कार्य में गति आई है साथ ही साथ संस्थान की राजभाषा कार्यान्वयन समिति की बैठकों में हिन्दी प्रगति से संबंधित आकड़ों का प्रस्तुतीकरण पावर - प्वाइंट के जरिये किया जा रहा है। ज्ञातव्य है कि संस्थान में बहुभाषी पैकेज “यूनीकोड” तथा “माइक्रोसॉफ्ट इंडिक लैंग्वेज इनपुट टूल्स ” का संस्थापन कम्प्यूटर पर किया गया है जिससे शब्द प्रक्रमण के अलावा आकड़ों के प्रक्रमण, आरेखीय निरूपण, आंकड़ों के समेकीकरण में आसानी एवं गति आई है।



16. SCIENTIFIC & ADMINISTRATIVE PERSONNEL OF CSR&TI AND ITS CONSTITUENT UNITS

Dr. B. B. Bindroo, Director

Scientist-E (R&S):

Shri M. K. Majumdar	Divisional head, Reeling & Spinning
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Scientists D:

Shri S. S. Manna (R&S)	Reeling & Spinning
Shri R. N. Dutta	Divisional head, Training (upto 31.12.2012)
Dr. A. K. Saha	Divisional head, Sericulture
Dr. N. K. Saha	Training Division (upto 11.07.2012) Entomology (from 12.07.12 to 31.01.13)
Dr. M. K. Ghosh	Divisional head, Moriculture
Dr. S. Roy Chowdhuri	Divisional head, PMCE

Scientists C/ B:

SERICULTURE DIVISION	
Silkworm Breeding & Genetics : Smt. Sunita Mukherjee , Sci.-C (from April, 12) Dr. M. Z. Khan, Sci.-C (upto April, 12) Dr. N. Suresh Kumar, Sci.-C Dr. S. Sreekumar, Sci.-C Dr. G.K. Chattopadhyay, Sci.-C (fr. July, 12) Dr. B. B. Pattnaik, Sci.-B (upto Feb., 13) Dr. H. Lakshmi, Sci.-B (upto Dec., 12)	SW Physiology & RTI : Sri T.N. Nath, Sci. –C Dr. (Mrs.) T. Dutta (Biswas), Sci.- C Entomology : Mrs. M. Patnaik, Sci.-C Silkworm Pathology Section: Dr. S. Chakrabarty, Sci.-B Shri Z. Hossain, Sci. – C (from 08.01.13) Biotechnology Section: Dr. (Mrs.) Rita Banerjee, Sci. – C Dr. S. Chattopadhyay, Sci. – C Smt. N. Lalitha, Sci. – B

MORICULTURE DIVISION	
Mulberry Breeding & Genetics: Dr. P. K. Ghosh, Sci. - C Dr. (Mrs) M. Chaudhuri, Sci.-C Shri N. K. Das, Sci.-C Agronomy : Dr. S. K. Mondal, Sci. – C Dr. S. Rajaram, Sci. – C Dr. S. Rahman, Sci.- C Mulberry Pathology : Dr. S. K. Dutta, Sci-C	Soil Science and Chemistry: Dr. S.K.Majumder, Sci.-C(upto 19. 05.2012) Dr. R. Kar, Sci.-C Mulberry Physiology: Dr. P. K. Tewari, Sci. –C Dr. A.K. Misra, Sci. –C



TRAINING DIVISION	PMCE DIVISION
Dr. L. M. Saha, Sci-C (fr 10.07.12) Sri R. K. Saha, Sci-C Dr. G.K. Chattapadhy, Sci-C (24.04-10.07.12) Smt. Sunita Mukherjee, Sci-C (upto 24.04.12) Dr.(Mrs) Jalaja S. Kumar, Sci-C	Dr. M. K. Singh, Sci. – C Shri Z. Hossain, Sci. – C (upto 07.01.13) Shri D. Chakravarty, Sci.-C (from 07.01.2013)
EXTENSION DIVISION	REELING & SPINNING DIVISION
Dr. S. K. Mukhopadhyay, Sci.-C Dr. M. V. Santha Kr, Sci.- C Dr. Subhra Chanda, Sci.- C Shri Debojit Das, Sci. – C	Shri N. B. Kar, Sci. –C
ADMINISTRATION	OFFICIAL LANGUAGE
Shri A. N. Mukherjee, A. D. (A & A)	Shri Ram Briksh Choudhary, A.D.

REGIONAL SERICULTURAL RESEARCH STATION:

RSRS, Kalimpong (West Bengal) Smt. C. Maji, Sci. - D Smt. Regina Bhutia, Sci.-C Shri S. Chatterjee, Sci. - C Dr. U. K. Bandyopadhyay, Sci. - C Dr. M. D. Maji, Sci. - C Shri Ram Lakhan Ram, Sci. - B	RSRS, Jorhat (Assam) Shri T. K. Biswas, Sci.- D Dr. S. N. Gogoi, Sci. - C Shri M. Sankar, Sci. - C Dr. Y. Debaraj, Sci. - C Smt. M. Pamehgam, Sci. - C
RSRS, Koraput (Odisha) Shri R. Sahu, Sci.- C Dr. N. R. Rao, Sci.- C Shri S. K. Misro, Sci.- C	RSRS, Ranchi (Jharkhand) Shri M. Alam, Sci.- C Dr. A. H. Naqvi, Sci.- C Dr. G. Singh, Sci.-C (upto 10. 05.12)

RESEARCH EXTENSION CENTRES & SUB UNITS:

REC, Mothabari (West Bengal) Shri A.K. Dutta, Sci. - C Dr. (Mrs.) J. Sarkar, Sci. - C	REC, Kamnagar (West Bengal) Dr. S.P.Chakraborti, Sci. - C Dr. D.Chakravarty, Sci.-C (upto 22. 12.12)
REC, M.P. Raj (Jharkhand) Dr. D. Pandit, Sci. - C	Sub, REC, Bhandra (Jharkhand) Sri Shankar Rai, TA
Sub-REC, Rajmahal (Jharkhand) Dr. A. K. Verma, Sci. - C	REC, Agartala (Tripura) Dr. G. B. Singh, Sci. - C
REC, Deogarh (Odisha) Dr. D. P. Dasmohapatra, Sci. - C Dr. K. M. Purohit, Sci. - C	REC, Gumla (Jharkhand) Dr. S.P. Sharma, Sci. - C
REC, Bademaranga (Chhattisgarh) Shri K. B. Chouhan, Sci. - C	REC, Dimapur (Nagaland) Dr. A. K. Bora, Sci. - C
REC, Shillong (Meghalaya) Dr. Collin Z. Renthlei, Sci-B	REC, Aizawl (Mizoram) Shri B. Chowdhury, Sci. – C Dr. Lalthlamuana Pachuau, Sci. - B
REC, Rongpo (Sikkim) Shri S.T. Lepcha, Sci. - C	REC, Imphal (Manipur) Dr. L. Somen Singh, Sci. – C



RESEARCH ADVISORY COMMITTEE

Chairperson Prof. M. Muniyamma Former Vice-Chancellor Gulbarga University, No.3, First Floor, 11 th Cross, 5 th Main Jayamahall Extension, Bangalore – 560 045	
Members	
1. Dr. H. K. Majumdar, Grade-G & Head, Molecular Parasitology Lab., Coordinator, Infectious Disease & Immunology Group, IICB, 4-Raja S.C. Mullick Rd, Kolkata-700 032	11. Director (Hand & Seri.), Deptt. of Industries, Govt. of Bihar, Vikas Sachivalaya, Patna- 800 015, Bihar
2. Dr. D. Sen, Ex-Director of Extension, NIRD, ICAR, Hyderabad, EB 1/12, Eshbandhunnagar, Baguihati, Kolkata – 700 059	12. Director of Textiles & Handloom Govt. of Orissa, Sahidnagar, Bhubaneswar - 751 007 Odisha
3. Prof. S. Maity Department of Agronomy, B-2/221, P.O. Kalyani – 741 235, Dist- Nadia, West Bengal	13. Director of Industries, Govt. of Jharkhand, III Floor, Nepal House, Doranda, Ranchi - 834 002, Jharkhand
4. Prof. D. K. Battacharya Department of Zoology, University of Kalyani, P.O. Kalyani – 741 235 Dist. Nadia, West Bengal	14. Director of Sericulture & Weaving Govt. of Meghalaya, 3 rd Sectt. (Nongkre building), 2 nd Ph, 2 nd Floor, Lower Iachumiere, Shillong – 793 001, Meghalaya
5. Dr. B. Saratchandra Director, Central Silk Board, P.O. Madiwala, BTM Layout, Bangalore – 560 068	15. Director of Sericulture, Govt. of Mizoram, Aizawl – 796 001, Mizoram
6. Dr. N. Suryanarayana, Ex-Director, CSB, D. No. 11-3-392/2/11/833, Srinivas Nagar Colony, Secunderabad – 500 061	16. Director of Handlooms, Handicrafts & Sericulture, Govt. of Tripura, Pandit Jawaharlal Nehru Complex, Gorkha Basti, Agartala – 799 006, Tripura
7. Director, NSSO, Central Silk Board P.O. Madiwala, BTM Layout, Bangalore – 560 068	17. Director of Sericulture, Govt. of Assam (Near Research Gate) P.O. Khanapara, Guwahati-781 022, Assam
8. Director of Textiles, Govt. of West Bengal, 45, Ganesh Chandra Avenue Kolkata, West Bengal	18. Addl. Director of Sericulture, Deptt. of Forest & Environment, Govt. of Sikkim, Deorali, Gangtok, Sikkim
9. Director, CSR&TI, Berhampore – 742 101 Murshidabad, West Bengal	19. Director of Sericulture, Govt. of Nagaland, Kohima – 797 001, Nagaland
10. Director of Sericulture, Govt. of Chhattisgarh, Resham Sanchanalaya, Kanij Bhawan, Telibandh, Raipur- 492 06, Chhattisgarh	20. Director of Sericulture, Govt. of Manipur, P.O.Lamphelpat, Imphal-795004, Manipur



17. SPECIAL ACTIVITIES ON WOMEN EMPOWERMENT, DEVELOPMENT OF SC/ST OR PEOPLE FROM BPL

The following human resource development programmes were conducted for empowerment and strengthening of the weaker section of the society.

17. A. MAIN INSTITUTE

17.A.1. STATEMENT OF SPECIAL ACTIVITIES ON WOMEN EMPOWERMENT, DEVELOPMENT OF SC/ST AND PEOPLE OF BELOW POVERTY LINE

Sl. No.	Training Prog.	Days / Period	Category					
			Gen	SC	ST	OBC	Minority	Total
Skill updating prog.								
1.	Mulberry varieties cultivation techniques used for farmers	5 11.09.12-15.09.12	12	8	-	3	-	23
2.	Integrated nutrient management	6 24.09.12-29.09.12	-	2	14	8	-	24
3.	Rearing technology & vermicompost, green manuring preparation	6 10.12.12-15.12.12	5	-	-	2	-	7
4.	Integrated disease & pest management	6 17.12.12-22.12.12	6	4	-	9	-	19
5.	Chawki rearing	10 02.01.13-11.01.13	2	4	-	3	-	9
6.	Late age silkworm rearing	10 16.01.13-25.01.13	1	3	2	9	-	15
7.	Rearing technology & vermicompost	6 11.02.13-16.02.13	10	1	2	1	-	14
8.	Integrated disease & pest management	6 18.02.13-23.02.13	4	1	-	1	-	6



ISDS (Farmers)								
9	Reeling & spinning	15 12.03.12- 26.03.12	1	4	-	5	5	15
10	Skill updating of extension agents	15 14.05.12- 28.05.12	9	4	-	2	-	15
11	Cocoon handicraft	15 13.08.12- 27.08.12	-	9	-	4	2	15
12	Mulberry cultivation	15 03.10.12- 17.10.12	7	5	-	-	3	15
13	Commercial silkworm rearing	15 19.11.12- 03.12.12	11	6	-	1	-	18
Adhoc training								
14	Silkworm rearing	5 19.02.13- 23.02.13	20	3	-	-	-	23

17. B. RSRS, Koraput:

17. B. 1. Trainers' Training Programme:

A Trainers' Training Programme was organized at Mulberry Farm, Parsoda, Kanker district of Chhattisgarh on 15th February, 2013 to impart training to the technical personnel of DoS, Chhattisgarh on Integrated Package of Practices for Mulberry cultivation, Integrated management of diseases & pests of mulberry, Soil testing & its reclamation and New Technologies of Silkworm Rearing & its package & management.

17. B. 2. Farmers' Training Programme:

A total of 40 farmers were trained in three Farmers Training Programmes at the premises of RSRS, Koraput on 14.09.2012 (12 Farmers), 11.10.2012 (18 farmers) and 09.01.2013 (10 farmers) of Lamtaput, Sonpur and Koraput villages of Koraput and Subarnapur districts of Odisha.

17. B. 3. Farmers field school:

With two lead farmers Shri Haribandhu Majhi and Shri Domain Majhi of Musulipadar village of Kashipur Block, Rayagada district (Odisha), 12 farmers' field school programmes were conducted and a total of 153 farmer were trained.



17.C. RSRS, Kalimpong:**17. C.1.Farmers' Training Programme:**

Seven women famers were trained on the improved technologies suitable for the region: Raising of seedling with black polythene cover, Reclamation of acidic soil, Pruning schedule for increase productivity of quality mulberry leaves, Use of plant growth hormone to increase leaf productivity, Forewarning of mulberry diseases and pests, Disinfection of rearing house, Use of bed disinfectant for prevention of silkworm diseases and Package for bivoltine silkworm rearing.

17.D. RSRS, Jorhat:**17.D.1. Extension Communication Programme (ECP):**

Various ECP prog. such as Awareness, Audio visual, Exhibition, Field day and Krishimela, a total of 1597 farmers of BPL group were trained on the topics, such as Maintenance of hygiene inside the rearing room, Application of room & bed disinfectant, Mulberry planting technique, Preparation and use of bio-fertilizer and a total of 905 farmers of BPL group were trained on the topics, such as Maintenance of mulberry garden, Disinfection and silkworm rearing, Package of practices of mulberry cultivation and silkworm rearing, land preparation & plantation techniques.

A total of 898 beneficiaries were trained on the topics, namely Control measures of mulberry and silkworm diseases & pests, Cultivation technique of high yielding mulberry variety and Rearing of bivoltine hybrids.

Moreover, disinfection of rearing house and appliances, agronomical practices of mulberry cultivation and chawki rearing methods were demonstrated.

17. D.2.Farmers' Training Programme:

30 famers of RSRS and 531 farmers of nested units were trained on the improved technologies suitable for the region for a development of sericulture.

17. D. 3. Farmers field school:

With two lead farmers of RSRS and two each of the 5 nested units, a total of 436 farmers were trained on the improved technologies for the development of sericulture in the region.



18. MISCELLANEOUS EVENTS / ACTIVITIES

18. A. PATENT / COMMERCIALIZATION

- ❖ **Technology filed for Patenting: Sericillin** - Silkworm bed disinfectant (Patent application registration No. IPR/11082-1 2012 dtd. 18/05/2012). The technology is under process of Patenting & have commercialized through NRDC, New Delhi.
- ❖ **Technology patented: Light weight rearing tray** (IP No. 237789 dated 10/05/2012). It is under the process of Commercialization through NRDC, New Delhi.
- ❖ **Technology under the process of commercialization: Silkworm Egg Box** (IP 212097 dtd. 15/11/2007) is under the process of commercialization through NRDC, New Delhi.

18. B. TRANSFER OF TECHNOLOGY

18. B. 1. Institute Village Linkage Programme [IVLP] :

Centre	No. of farmers	
	Target	Achievement
CSR&TI Berhampore	90	90
RSRS [4]	200	200
REC [12]	680	680
REC Sub-unit [2]	50	50
Total	1020	1020

18. B. 2. Monitoring of Cluster farmers

Cluster	State	No. of farmers
Nabagram	West Bengal	600
Kaliachak	West Bengal	675
Serchip	Mizoram	236
Total		1511

18. B. 3. Validation Programmes at farmers' level:

Title	State	No. of farmers
Validation of thiamethoxam at farmers' level.	West Bengal	105
Improvement of mulberry seed cocoon production at farmers' level with special reference to Bivoltine seed cocoon in West Bengal.	West Bengal	50
Total		155



18. B. 4. Popularization of technologies:

Sl. No.	Technology	Target	Achievement
1.	Testing of new mulberry variety (Tr-23) (Farmers)	15	15
2.	Testing of new silkworm hybrids & popularization of authorized hybrid (Dfls)	6980	13375
3.	Soil test based fertilizer application (Farmers)	39	39
4.	S-1635 Mulberry variety (Expansion in acres)	45	60.1

18. C. Training programmes:

Centre	No. of farmers	
	Target	Achievement
RSRS [4]	FTP 120 TTP 04	FTP 179 TTP 04
REC [12]	FTP 63	FTP 76 (2593 farmers)
REC Sub-unit [2]	FTP 05	FTP 05 (327 farmers)
Total	FTP 68; TTP 04 120 farmers	FTP 81; TTP 04 3099 farmers

FTP – Farmers' Training Programme, TTP – Trainers' Training Prog.

18. D.1. Extension Communication Prog. of Institute and Nested Units

Centre	Awareness		AV Prog.		Exhibition		Field day		R K Mela	
	T	A	T	A	T	A	T	A	T	A
CSR&TI	05	09	01	01	02	04	-	01	01	01
RSRS [4]	15	16	10	11	12	11	10	10	04	04
REC [12]	43	45	41	40	40	40	41	41	-	-
Sub-REC[2]	05	05	05	06	04	04	05	06	-	-
Sub total	68	75	57	58	58	59	56	58	05	05
Total	T: Target = 244					A: Achievement = 255				

18. D.2. Number of stakeholders sensitized

Sl. No.	Name of the prog.	No. of events Achievements (Target)	Farmers sensitized
1.	Awareness Prog.	75 (68)	4278
2.	Audio-Visual Prog.	58 (57)	2844
3.	Exhibition	59 (58)	5710
4.	Field day	58 (56)	2832
5.	Resham Krishi Mela	5 (5)	910
6.	Farmers' Training Prog.	RSRS: 179(120); RECs: 76(63)	3278
7.	Trainers' Training Prog.	4 (4)	8
			19,860(12,000)



18.E. Popularization of soil test based NPK fertilizer application for mulberry under ToT (Soil Science & Chemistry Section):

Soil test based mode of NPK fertilizer application ensures balanced nutrition of mulberry with due consideration to the differential availability of soil nutrients. Through this approach over- or under- use of fertilizer elements can be averted by application on the basis of soil test value and greater economy in fertilizer use and efficiency can be achieved for sustainable mulberry production. Further, it assures maintenance of soil health. To popularize the technology at field level, the same has been demonstrated in the mulberry garden of 39 nos. of farmers distributed over irrigated as well as rainfed conditions of Eastern and North-Eastern India. The technology along with general recommendation of NPK fertilizer application (control) has been executed at farmers' level through 13 nos. of RECs comprising 03 nos. of farmers under each REC. Fertilizers were applied crop wise at plots under control as well as technology concerned and corresponding leaf productivity were recorded. Comparative advantage of soil test based NPK fertilizer application over general recommendation has been confirmed in terms of 10.39% and 13.17% leaf yield increase in irrigated and rainfed condition respectively. Comparative economics of the technology over the existing one is furnished below:

Comparative economics of Soil test based NPK fertilizer application over general recommendation.

Fertilizer application	Leaf yield (mt ha ⁻¹ yr ⁻¹)	Gross product value (Rs.)	Cost of taking up technology (Rs.)	Profit (Rs.)	Net production value
Irrigated					
General	35.60	89000	27803	61197	2.20
Soil test based	39.30	98250	23531	74719	3.18
Rainfed					
General	10.02	25050	11534	13516	1.17
Soil test based	11.34	28350	9194	19156	2.08

Cost of mulberry leaf: Rs. 2.50/- per kg; Cost of FYM: Rs. 600/- per mt Cost of urea: Rs.5.63/- per kg; Cost of SSP: Rs. 8.00/- per kg; Cost of MOP: Rs.14.40/- per kg.



19. METEOROLOGICAL DATA

I. CSR&TI, BERHAMPORE (Latitude 24°6'N, Longitude 88°15'E, Altitude 19 M above MSL)

Month	Temp. (°C)		RH (%)		Rain fall (mm)	Rainy days (No.)	Wind velocity (km ph)	Bright sunshine (hrs)	Evaporation (mm/hr)
	Max	Min.	Max.	Min.					
April, 12	35.1	22.9	95.4	40.7	32.5	05	1.68	9.4	0.29
May	37.2	25.2	96.7	43.7	52.5	03	1.58	9.8	0.33
June	35.9	26.5	97.3	61.9	119.0	12	1.69	9.1	0.26
July	32.6	26.0	95.7	78.9	348.5	25	1.43	8.4	0.11
August	33.2	26.2	89.7	69.7	68.1	10	1.20	8.7	0.30
September	33.1	25.5	92.9	70.2	235.0	16	1.22	8.3	0.08
October	31.6	21.2	92.5	58.4	0.00	0	0.95	8.7	0.09
November	27.2	16.1	90.8	51.9	126.0	03	1.51	6.4	0.08
December	23.1	12.0	94.5	56.4	0.00	0	1.77	4.3	0.04
January, 13	22.7	9.5	83.1	45.2	0.00	0	2.10	3.6	0.08
February	27.5	14.0	73.6	44.4	20.7	3	8.78	6.9	0.09
March	33.5	18.8	69.7	40.8	0.00	0	2.36	7.4	0.13

India Meteorological Department/ Regional Meteorological Centre, Kolkata installed surface Meteorological observatory at CSR&TI, Berhampore for daily recording and transmission of meteorological data at 3.30 GMT (8.30 AM) and 12.30 GMT (5.30 PM).

II. REGIONAL SERICULTURAL RESEARCH STATION:

KALIMPONG, WEST BENGAL

Month	Temp. (°C)		RH (%)		Rain fall (mm)	Rainy days (No.)
	Max	Min.	Max.	Min.		
April, 12	27.00	16.32	90.11	52.88	130.81	12
May	30.34	19.01	89.95	48.47	45.60	11
June	27.68	21.60	98.93	71.15	356.40	24
July	27.80	21.50	98.46	72.38	337.00	21
August	29.98	21.45	98.47	63.83	248.90	26
September	27.97	20.67	99.06	67.61	404.30	21
October	26.21	17.15	85.29	67.55	0.00	0
November	25.23	12.43	86.53	36.90	0.00	0
December	22.13	10.06	89.68	41.74	0.00	0
January, 13	21.29	8.06	80.19	32.16	6.30	1
February	24.68	11.54	80.86	34.93	31.90	2
March	26.45	14.29	85.52	38.16	46.00	8



JORHAT, ASSAM

Month	Temp. (°C)		RH (%)		Rain fall (mm)	Rainy days (No.)
	Max	Min.	Max.	Min.		
April, 12	30.2	21.0	98	52	73.5	12
May	33.2	23.0	99	43	132.6	13
June	35.0	23.0	99	68	1423.0	20
July	36.0	25.0	99	69	1885.0	13
August	36.0	24.0	99	63	913	23
September	36.0	24.0	99	68	516	19
October	34.0	20.0	99	60	288	14
November	29.0	14.0	96	53	-	-
December	28.0	5.0	95	44	-	-
January,13	28.0	6.0	95	38	-	-
February	31.0	12.0	93	41	-	-
March	33.0	17	98	34	54	10

KORAPUT, ODISHA

Month	Temp. (°C)		RH (%)		Rain fall (mm)	Rainy days (No.)
	Max	Min.	Max.	Min.		
April, 12	17.2	38.7	8.5	95.1	71.2	21
May	19.7	42.0	8.5	91.8	50.7	10
June	19.9	41.6	9.4	98.9	116.3	10
July	19.9	34.1	43.2	96.7	415.1	21
August	20.1	31.4	52.0	97.9	518.4	27
September	19.7	30.9	38.4	96.9	347.1	14
October	15.2	33.7	19.0	95.6	39.3	6
November	10.3	31.1	19.0	97.9	100.5	5
December	10.8	32.2	11.2	96.0	--	--
January,13	10.1	31.8	6.8	94.9	--	--
February	13.0	35.0	6.8	86.5	12.8	2
March	14.1	38.8	6.8	93.90	20.2	3

RANCHI, JHARKHAND

Month	Temp. (°C)		RH (%)		Rainy days (No.)
	Max	Min.	Max.	Min.	
April, 12	35.23	24.07	76.77	53.43	4
May	36.70	25.48	67.77	44.08	1
June	37.67	28.83	74.50	46.23	6
July	32.77	24.81	83.54	68.19	11
August	31.48	25.13	86.84	76.16	15
September	30.50	24.13	85.60	72.20	19
October	29.71	22.26	82.71	55.74	11
November	24.07	19.10	65.37	45.23	5
December	21.10	13.48	64.61	45.48	-
January,13	22.61	9.81	71.00	48.84	-
February	25.07	12.21	73.82	55.61	4
March	27.84	20.03	47.48	37.52	6



20. ADMINISTRATIVE REPORT

Central Sericultural Research & Training Institute, Berhampore (West Bengal) and its allied units are as follows:

RSRSs

1. Kalimpong (WB)
2. Koraput (Odisha)
3. Ranchi (Jharkhand)
4. Jorhat (Assam)

RECs

- | | |
|---------------------------------|-----------------------------|
| 1. Kamnagar, Murshidabad (W.B.) | 7. Maheshpur Raj Jharkhand) |
| 2. Mothabari, Malda (W.B.) | 8. Agartala (Tripura) |
| 3. Rangpo (Sikkim) | 9. Dimapur (Nagaland) |
| 4. Deogarh (Odisha) | 10. Imphal (Manipur) |
| 5. Bademaranga (Chhattisgarh) | 11. Shillong (Meghalaya) |
| 6. Gumla (Jharkhand) | 12. Aizawl (Mizoram) |

Sub-RECs: 1. Bhandra (Jharkhand), 2. Rajmahal (Jharkhand)

A. STAFF POSITION : MAIN INSTITUTE

Category	Sanctioned	Filled	Vacant
Director	1	1	-
Scientific	56	37	19
Technical	55	51	4
Administrative	74	64	10
Supporting	28	22	6
Total	214	175	39

B. OFFICERS & STAFF RETIRED:

Sl. No.	Name of the employees	Designation	Date of retirement
1.	Smt. Anjali Roy	Attender	31.05.2012
2.	Shri Ratan Kr. Kurmi	Asst. Technician	30.09.2012
3.	Shri Bipad Bhanjan Majhi	S.C.D. Gr.1	30.11.2012
4.	Shri Rabindranath Dutta	Scientist-D	31.12.2012
5.	Shri Biswanath Mondal	Attender	31.12.2012
6.	Dr. Nakul Kumar Saha	Scientist-D	31.01.2013
7.	Shri Krishna Sadhan Roy	STA	31.01.2013
8.	Shri Joydeb Das	Asst. Technician	31.01.2013
9.	Shri Samsuddin Sk.	Attender	28.02.2013
10.	Shri Tapas Narayan Nath	Scientist-C	31.03.2013

OFFICERS & STAFF EXPIRED:

1.	Shri N. K. Roy	STA	19.02.2013
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OFFICERS & STAFF RESIGNED FROM BOARD'S SERVICE

1.	Dr. (Mrs) H. Lakshmi	Scientist -B	06.12.2012
2.	Dr. B. B. Patnaik	Scientist-B	15.02.2013

C. BUDGET (Rs. in lakh):

Plan	Non-Plan	NE-Plan	Total
207.48	2336.78	30.50	2574.76

