वार्षिक अनुसंधान एवं प्रशासनिक प्रतिवेदन

Annual Research & Administrative Report

2017-18



केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान Central Sericultural Research & Training Institute केंद्रीय रेशम बोर्ड, वस्त्र मंत्रालय, भारत सरकार Central Silk Board, Ministry of Textiles, Govt. of India बहरमपुर - 742101, पश्चिम बंगाल Berhampore - 742101, West Bengal

Credit Line.....

Editor-in-Chief

Dr. Kanika Trivedy Director Central Sericultural Research & Training Institute, Berhampore (W.B.)

Editor

Dr. Dipesh Pandit Scientist-D

Associate Editor

Dr. Manjunatha G.R. Scientist-B

Assisted by

Shri Subrata Sarkar Smt S. Karmakar (Mustafi) Shri P. Banerjee Technical Assistants

Hindi Version

Shri R. B. Choudhary Assistant Director (OL)

Shri Chandan Kr. Shaw Jr. Translator (Hindi)

Graphics & DTP Shri S. Sarkar, TA & T. Naga Teja Shirisha, Steno, Gr.-II

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प्रस्तावना

केन्द्रीय रेशम उत्पादन अनुसंधान और प्रशिक्षण संस्थान, बहरमपुर, पश्चिम बंगाल मे 15 अक्टूबर, 1943 से अपनी यात्रा शुरु किये थे और 74 साल पूरे किए हैं और 75 वें वर्ष में कदम उठाए हैं और प्लैटिनम जयंती वर्ष मना रहे हैं। यह भारत में अपनी तरह का प्रीमियर अनुसंधान संस्थान है और

सरकार ने "वाणिज्य और उद्योग मंत्रालय" के प्रशासनिक नियंत्रण के तहत सीधे काम करना शुरू कर दिया है। केन्द्रीय रेशम अनुसंधान संस्थान (सी.एस.आर.एस) के नाम पर जाना जाता था। वर्ष 1969 में, इसे केन्द्रीय रेशम बोर्ड (सी.एस.बी.) के तकनीकी और प्रशासनिक नियंत्रण में लाया गया और इसके नाम केन्द्रीय रेशम उत्पादन अनुसंधान और प्रशिक्षण संस्थान मे परिबर्तित किया गया है।

स्थापना के बाद से, यह संस्थान लगातार कृषि और उद्योग के पूर्वी और उत्तर-पूर्वी क्षेत्र के किसानों के लंबवत आर्थिक विकास की दिशा में अनुसंधान आधारित अनुसंधान के माध्यम से उत्कृष्टता बनाए रखने की कोशिश कर रहा है। इस संस्थान लगातार उत्पादन सुनिश्चित करने के लिए किसानों के खेतों से संबंधित विभिन्न मुद्दों को हल करने का प्रयास कर रहा है। मिट्टी स्वास्थ्य कार्ड को डिजिटलीकरण के लिए दबाव वनाया गया है, छोटे खेतों के मशीनीकरण को बढ़ावा देता है और उच्च उपज वाले शहतूत किस्मों के परिचय के माध्यम से शहतूत के पत्ते के उत्पादन में वृद्धि करता है और सूचना प्रौदयोगिकी और डेटा बेस के विकास के माध्यम से 'लैब-टू-लैंड' कार्यक्रम से प्रौदयोगिकी को लागू करने पर जोर दिया जाता है।

तकनीकी और विस्तार नेटवर्क के माध्यम से पूर्वी और पूर्वोत्तर क्षेत्र के 13 राज्यों में स्थित तीन क्षेत्रीय रेशम अनुसंधान संस्थान (आर.एस.आर.एस.) और तेरह अनुसंधान विस्तार केंद्र (आर.ई.सी.), स्थलाकृति और कृषि जलवायु स्थितियों में बदलाव के साथ हितधारकों को सहयोग प्रदान किया जा रहे हैं।

मुझे यह कहते हुए खुशी हो रही है कि संस्थान के वैज्ञानिकों, अधिकारियों और कर्मचारियों ने एक टीम के रूप में अपने प्रयासों के माध्यम से संस्थान की आई.एस.ओ. 9001:2015 गुणवत्ता मानक की स्थापना और रखरखाव किया और इस क्षेत्र में रेशमचाष मे नियोजित किसानों / हितधारकों को समर्थन देने के लिए समर्पित किया। अनिवार्य परिणाम फ्रेमवर्क दस्तावेज (आर.एफ.डी), 29 शोध परियोजनाओं, 06 कार्यक्रमों और 1 पायलट अध्ययन संस्थान और इसकी अधीनस्थ इकाइयों में रेशम उद्योग के विभिन्न पहलुओं में समस्याओं को हल करने के लिए जारी रखा गया था, जिनमें से 8 परियोजनाओ और 4 सामान्य कार्यक्रम अभी शुरू किए गए थे और 11 परियोजनाएं, 1 पायलट अध्ययन और 1 सामान्य कार्यक्रम निष्कर्ष निकाला गया था। इन परियोजनाओं, कार्यक्रमों और पायलट अध्ययनों ने पेशेवरों और हितधारकों में क्षमता निर्माण के माध्यम से बेहतर शहतूत की किस्मों, रेशमकीट की नस्लों / संकर में सुधार, उनके प्रबंधन और विस्तार गतिविधियों के विकास में उल्लेखनीय उपलब्धियां हासिल की हैं। इसके अलावा, संस्थान ने अन्य राष्ट्रीय प्रतिष्ठित संस्थानों के साथ अपने शोध परियोजनाओं को भी सहयोगी बना लिया है।

इस क्षेत्र में लक्षित अनुसंधान एवं विकास को प्राप्त करने के लिए संस्थान के वैज्ञानिको को, समन्वय समिति (आरसीसी), अनुसंधान सलाहकार समिति (आर.ए.सी.) और क्षेत्रीय अनुसंधान सलाहकार समिति (आर.आर.ए.सी.) की अध्यक्ष और सदस्यों द्वारा प्रदान किए गए मूल्यवान मार्गदर्शन को ईमानदारी से स्वीकार किया गया है।

मैं चाहता हूं कि अनुसंधान व बिकाश, बिस्तार, मानव संसाधन और हितधारकों के लिए सेवा सहायता की मानक और उत्कृष्टता आने वाले वर्षों में भी कायम रहे। साथ ही साथ, मैं, संस्थान तथा इसके अधीनस्थ इकाइयों के वैज्ञानिकों / अधिकारियों / पदधारियों के प्रयास की सराहना करती हूँ। मैं, केन्द्रीय रेशम बोर्ड / राज्य स्तरीय रेशम निदेशालय/ वस्त्र निदेशालय, केंद्रीय सरकार द्वारा रेशम उद्योग के हितलाभ हेतु प्रदत्त उनके अमूल्य सहयोग के प्रति अपना आभार प्रकट करती हूँ।

मुझे विश्वास है कि 2017-18 की केन्द्रीय रेशम उत्पादन अनुसंधान और प्रशिक्षण संस्थान की वार्षिक अनुसंधान तथा प्रशासनिक रिपोर्ट एक मूल्यवान सूचना का खजाना होगी और नीति निर्माताओं और किसानों को समान रूप से मार्गदर्शन करायेगी।

[डॉ. कणिका त्रिवेदी] **निदेशक**

FOREWORD



Central Sericulture Research and Training Institute, Berhampore West Bengal has completed 74 years of its journey since 15th October, 1943 and stepped on 75th year and is **celebrating Platinum Jubilee Year**. It is the premiere research institute of its kind in India and started working directly under the administrative control of "**Ministry of Commerce and Industry**", Govt. of India in the name of **Central Sericultural Research Station (CSRS).** In the year the 1969, it was brought under the technical & administrative control of Central Silk Board (CSB).

Since inception, this institute is consistently improving for sustainable development of sericulture industry and trying to maintain excellence through need based research towards vertical economic growth of the farmers of Eastern and North-Eastern region of the country. The institute is continuously striving to solve different issues related to farmers' fields to ensure sustainable production. Stress has been laid for digitization soil health card, promotes mechanization of small farms and increase mulberry leaf production through introduction of high yielding mulberry varieties and emphasized to implement the technology from 'Lab-to-Land' programme through information technology & development of data base and technology.

Through extension network *viz*. three Regional Sericultural Research Stations (RSRSs) and thirteen Research Extension Centres (RECs) located at 13 states of Eastern and NE region, support are being provided to the stakeholders with variations in topography and agro climatic conditions.

I am happy to say that the Institute's scientists, officers and officials through their untiring efforts as a team established and maintained the Institute **ISO 9001: 2015** quality standard and dedicated to support to the sericulture farmers/ stakeholders in the region. With the mandated Results Framework Documents (RFD), 29 research projects, 06 programmes and 1 pilot study were continued at the Institute and its nested units for addressing problems in various aspects of sericulture industry, of which, 8 projects and 4 programmes were just initiated and 11 projects, 1 pilot study and 1 programme were concluded. These projects, programmes and pilot studies made remarkable achievements in development of improved mulberry varieties, silkworm breeds/ hybrids, their management and extension activities through capacity building in professionals and stakeholders. In addition, the institute has also tied up its research with other nationally reputed institutes.

Sincerely acknowledged the valuable guidance rendered by the learned Chairpersons 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.

I wish the standard and quality of R&D, Extension, HRD and service support for the stakeholders will stand with the years to come and appreciate the efforts of the scientists, officers and officials of this institute and nested units. Supports from CSB/ DoS/ DoT acknowledged for the benefit of the sericulture industry.

I am confident that Annual Report of 2017-18, CSR&TI would be a valuable information treasure and would guide policy makers and farmers alike.

[Dr. KanikaTrivedy] Director

1a. मुख्य सारांश

केन्द्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, बहरमपुर अपने 03 (तीन) अधीनस्थ क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्रों [क्षेरेउअके] तथा 13 अनुसंधान विस्तार केन्द्रों [अविके] के साथ पूर्वी तथा उत्तर-पूर्वी राज्यों में रेशम उद्योग के विकास में उल्लेखनीय योगदान करते आ रहा है। अनुसंधान व विकास का ध्यान पूर्वी (5) तथा उत्तर-पूर्वी(8) राज्यों के रेशम निदेशालय/रेशम उद्योगो के साथ घनिष्ठ संबंध स्थापित कर रेशम कृषकों तथा हितधारकों के लाभार्थ क्षेत्रीय अवश्यकताओं, विस्तार व मानव संसाधन विकास आधारित प्राथमिकताओं पर मुख्य रुप से केन्द्रित था।

अनेकों काल तक, देश के पूर्वी भाग समेत पश्चिम बंगाल जलवायु आपदाओं के कारण द्विप्रज रेशम कृषि के लिए प्रतिकूल क्षेत्र के तौर पर जाना जाता था लेकिन विस्तार गतिविधियों के अथक प्रयासों से उन सभी आपदाओं पर काबू पाने के फलस्वरुप इस क्षेत्र में द्विप्रज रेशम उत्पादन में गति आई है।

अवधि के दौरान रेशम उद्योग के विविध समस्याओं के समाधान से संबंधित 36 अनुसंधान परियोजानाएं एवं कार्यक्रम [29 परियोजनाएं, 1 पॉयलट अध्ययन तथा 6 कार्यक्रम] जारी थे। वर्ष के दौरान, कुल 11 परियोजनाएं, 1 पॉयलट अध्ययन तथा 1 कार्यक्रम को संपन्न करते हुए कुल 8 परियोजनाएं एवं 4 कार्यक्रम प्रारंभ की गई।

वर्ष 2017-18 के दौरान प्राप्त मुख्य उपलब्धियाँ निम्नानुसार हैः

शहतूत सुधार और उत्पादकता

- S-1635 (क्रमशः 44.13 व 26.84 टन/हे./वर्ष) के नियंत्रण की तुलना में एनपीके के क्रमशः पूरी तथा आधी खुराक के तहत वार्षिक पर्ण उपज 49.89 एवं 34.01 टन/हेक्टेयर/वर्ष समेत कम उर्वरक मिट्टी के लिए उपयुक्त अधि-उत्पादक शहतूत जीनप्ररुप C-9 की पहचान की गई है।
- नम दबाव वाले अवस्था के अधीन तीस (30) आशाजनक शहतूत जीनप्ररुप चिहिनत किए गए हैं जो वर्तमान की वर्षाश्रित प्रजातियों, C-2038(1.88 किग्रा./वर्ष) की अपेक्षा महत्वपूर्ण तौर पर अधि वार्षिक पर्ण उपज (>1.963 किग्रा/पौध) समेत बेहतर शरीरक्रियात्मक ट्रेट्स अर्थात् विशिष्ट पर्ण क्षेत्र (<250 g cm⁻²), क्लोरोफिल की मात्रा (>15 µg cm²), पर्ण आकार (>150 cm²) तथा नमी की मात्रा के साथ बेहतर पैदावर कर सकती है।

- छंटाई के 21 तथा 28 दिन बाद समुद्री खर-पतवार तत्वों (0.5 ml/L की दर से एस्कोफाईलम नोडसम) का छिड़काव करें। 60वें दिन एस-1635 (328.33 ग्रा/पौध) (30 पौधो का औसत) के नियंत्रण की तुलना में पर्ण उपज (11%) में वृद्धि दर्ज की गई।
- बिना घास मिश्रित गहन जुताई (576 किग्रा /हे/फसल) की तुलना में घास मिश्रित हल्की जुताई में ~9% कार्बन धारिता क्षमता की सुधार (632 किग्रा/हे/फसल) दर्ज की गई है।
- अवधि के दौरान 5640 मृदा स्वास्थ्य कार्ड संवितरित किए गए हैं तथा 1144 मृदा स्वास्थ्य कार्ड संवितरण हेत् तैयार है।
- सौर पंप आधारित कम लागत वाले ड्रमकिट और दबावयुक्त ड्रिप टेप फर्टिगेशन प्रणाली के मूल्यांकन के संबंध में, ड्रिप टेप फर्टिगेशन समेत 100% आरडीएफ के अधीन 528 ग्रा/पौध (3'×3') तथा 255 ग्रा/पौध (2'×2') में अधिकतम पर्ण उपज दर्ज की गई तथा सतही सिंचाई के साथ एस-1635 प्रजाति के 100 % आरडीएफ के मृदा अनुप्रयोग की तुलना में क्रमशः 34% एवं 19% अधि पर्ण उपज दर्शायी गई।
- क्षेरेउअके, जोरहाट में जननद्रव्य भू-खंड में 23 एक्सेशन का रख-रखाव किया जा रहा है जिसमें MI-0349 (11.217 ट/हे/वर्ष) तथा MI-879 (10.956 ट/हे/वर्ष) में उल्लेखनीय तौर पर अधिकतम पर्ण उपज दर्ज की गई है जिसका उपयोग आनुवंशिक संसाधन सामग्री के तौर पर किया जा सकता है।

शहतूत संरक्षण

- रेशम हितधारकों को सीधे लाभ पहुंचाने की दृष्टि से शहतूत पीड़कों के सर्वेक्षण व निगरानी से जुड़ी पूर्व-संसूचना समेत प्रतिकारी उपाय "एम-किसान पोर्टल" के माध्यम से कृषकों तक संदेश (मैसेज) प्रसारित की जाती है।
- चुर्णिल आसिता प्रतिरोधी आशाजनक शहतूत संततियों के मूल्यांकन में दो आशाजनक संततियों ने एस-1635 की अपेक्षा ~ 17-29% अधि-पर्ण जैवमात्रा दर्शाया है जिसमें से सी-1360 को एमवीएसी (2018-2023) द्वारा एआइईसीईएम चरण IV के परीक्षण हेतु चयन किया गया है। फेनोटाइपिंग के साथ संततियों के तीन पीढियों के विसंयोजन हेतु ~30 चूर्णिल आसिता विशिष्ट अनुमानित मार्करों का परीक्षण किया गया। 182bps (MM68) तथा 190bps (MM128) की दो एलिलिक बैंड फेनोटाइपिक रोग प्रतिक्रिया के साथ मजबूत पारस्परिक-संबंध दर्शाता है।

- आशाजनक जीवाणु पर्ण चित्ती (बीएलएस) प्रतिरोधी के मूल्यांकन के अंतर्गत सी-2038 (50-53 ट/हे/वर्ष) की तुलना में दो आशाजनक लाईनों में ~ 9-16% अधि-जैवमात्रा दर्ज की गई।
- शहतूत पारिस्थितिक-तंत्र में पीड़क तथा प्राकृतिक शत्रुओं के जनसंख्या पारस्परिक-क्रिया के अधीन प्रमुख शहतूत पीड़कों तथा उनके वैकल्पिक परपोषी पौधों व प्राकृतिक शत्रुओं के अजैविक कारकों से जटिल संबंधों को डक्यूमेंटेड किया गया तथा कृषकों के मध्य जागरुकता के लिए इसे लोकप्रिय बनाया गया।
- शहतूत जननद्रव्य एक्सेशनों में श्वेत मक्खी के आपतन के संबंध में यह देखा गया है कि 154 शहतूत एक्सेशनों में से 10 एक्सेशन श्वेत मक्खी के आपतन हेतु अपेक्षाकृत सहिष्णु (1-4 संख्यक प्रति पर्ण) पाए गए जो शहतूत प्रजनन में श्वेत मक्खी के प्रतिरोध हेत् उपयोगी होगा।

रेशमकीट सुधार और उत्पादकता

दो नए संकर नामतः HTH3 × HTH6 व HTH4 × HTH9 अधि तापमान एवं अधि आर्द्रता 35 ± 1°C व 85 ± 5 % अवस्था के लिए सहिष्ण् (>65%) पाए गए।

- शाटल प्रजनन एप्रोच (AIB:3617) के माध्यम से दो नए द्विप्रज एकल संकर नामतः BHP-2 x BHP-8 एवं BHP-3 x BHP-8 विकसित किए गए जो कि SK-6 x SK-7 तथा B. Con.1 x B. Con.4 की अपेक्षा उत्कृष्ट है। उत्पादकता मेरिट जैसे कि कवच प्रतिशत (5 to 10%) है जबकि फिटनेस मेरिट बराबर है।
- दिनांक 19.02.2018 को संकर प्राधिकरण समिति द्वारा पूर्वी तथा उत्तर-पूर्वी राज्यों के लिए SK6 x SK7 के नियंत्रण के साथ एक नए द्वि x द्वि संकर- B.Con.1 x B.Con.4 तथा N x (SK6 x SK7) के नियंत्रण के साथ बहु x द्वि संकर -M6DPC x (SK6 x SK7) प्राधिकृत किया गया।
- पांच नस्लें अर्थात् 1. M.Con.4 ld (स्यूडो वर्णित उपरति संदमक पीले अंडेकार आकृति का कोसा),
 2. M.Con.4 ld (नॉन स्यूडो उपरति संदमक पीले अंडेकार आकृति का कोसा),
 3. M.Con.4 ld (स्यूडो वर्णित उपरति मक्खन के रंग का कोसा),
 4. B.Con.4 ld (स्यूडो वर्णित मक्खन के रंग का कोसा) तथा
 5. BHB ld (स्यूडो वर्णित सफेस रंग के अंडेकार व डम्बबेल) के साथ आईडी लक्षण वाले विकसित किए गए। द्वि x बहु रोमुच के निर्माण हेतु दो नस्लों का उपयोग किया गया तथा द्वि x बहु रोमुच के जिर्माण हेतु दो नस्लों का उपयोग किया गया।

 अवधि के दौरान 6080 P1 रोमुच विभिन्न राज्यों एवं संगठनों तथा प्राधिकरण परीक्षण के अधीन 600 कृषकों को 0.97 लाख संकर की आपूर्ति की गई।

रेशमकीट संरक्षण

- रेशमकीट में रोग प्रबंधन हेतु पूरक आहार के तौर पर फोटोट्रोफिक जीवाणु तत्वों की प्रभावोत्पादकता के रक्षावरण के लिए जेनेरा से संबंधित तीन जीवाणु प्रभेद रहोडोभूलम, रहोडोबेक्टर व रहोडोस्यूडोमोनास का पालन किया गया। उपरोक्त तीन जीवाण्विक, संवर्धन को इस्तेमाल कर विभिन्न खुराक पर स्वतंत्र रूप से खाद्य की प्रभावकारिता की भी जाँच की गई । 4 नस्लों और 1 संकर (एम। कॉन .1 एक्स बीकॉन 4, एसके -6, एसके -7, बीकॉन-1 और बीकॉन-4) पर किए गए जैव-आमापन अध्ययन अध्ययनों के अंतर्गत पूरक आहार में न तो कोई आविषालुता और ना ही कोसा की उत्तरजीविता, कोसा कवच भार एवं तंतु लंबाई में कोई महत्वपूर्ण परिवर्तन नहीं पाया गया।
- जीवाणु प्रभेद के विरुद्ध एंटीबैक्टीरियल प्रोटीन अंशों का वियोजन, शुद्धिकरण और लक्षण वर्णन के लिए प्राप्त किया गया। लिपोप्रोटीन जीन की पूर्ण लंबाई 5' और 3' सिद्ध कर इसके की अनुक्रम की पुष्टि आरएसीई द्वारा की गई। लिपोप्रोटीन जीन का क्लोन पिचिया पादरीस में इसके पुनः संयोजक अभिव्यक्ति के लिए किया गया । परिवर्तित पिचिया पासटॉरीस चयनित माध्यम एवं कोशिका गुटिका में द्रव्य संवर्धन के विषयाधीन था। प्रोटीन को कोशिका एवं अधिप्लवी दोनों से निकाला गया था। प्रोटीन की पुनः संयोजक अभिव्यक्ति एसडीएस-पेज, जीवाणुरोधी विश्लेषण के बाद एंटी हिस्टिडाइन एंटीबॉडी का उपयोग करके पश्चिमी ब्लॉट द्वारा पुष्ट की जायेगी।
- 11 द्विप्रज नस्लों की थर्मो-सहिष्णु क्षमताओं की जांच उत्तरजीविता, कोशितीकरण तथा 25° सें के नियंत्रण की तुलना में 35° सें के साथ 75% आर्द्रता के व्यवस्था के अधीन रिएक्टव ऑक्सीजन स्पेशिज (आरओएस) स्थिरीकरण क्षमताओं के आधार पर की गई। तीन नस्लें (B.Con.4 > B.Con.1 > BHR-3) उत्तरजीविता एवं सुपरऑक्साइड डिसम्यूटेस (एसओडी) गतिविधि के आधार पर ताप-सहिष्णुता को दर्शाता है।
- वाणिज्यिक फसल (849 नमूने) के दौरान नैमिक सर्वेक्षण संपन्न किया गया तथा रोगों के कारण होने वाले फसल हानि को कम/नियंत्रित करने के दृष्टिकोण से निवारक/प्रतिकारी उपायों की सलाह हितधारकों को नियमित तौर पर दिया जा रहा है। मौसमविज्ञान-संबंधी डाटा भी नियमित तौर पर संग्रहित व अद्यतित की जा रही है और उक्त को रेशमकीट रोग आपतन से सहसंबंध स्थापित किया जायेगा। बैशाखी

(अप्रैल) फसल के दौरान गैटिन - 6.8% (3.9 - 11.5%) की व्यापकता थी, जेठ (मई-जून) व भाद्री (अगस्त) फसल में 7.1 से 7.3% ग्रैसरी रोग की रिपोर्ट की गई।

 बीज फसल (3731नमूने) के दौरान पश्चिम बंगाल, झारखंड तथा ओडिशा के 91 गांव/रेशम निदेशालय के कृषकों से 3731 नमूने संग्रहित किए गए। 5.85 % ग्रैसरी रोग रिपोर्ट की गई। उत्तर-पूर्वी राज्यों में 7 राज्यों के 60 गांवों से 329 नमूने संग्रहित किए गए तथा जून-जुलाई,17 फसल के दौरान ग्रैसरी रोग की प्रंचडता पाई गई।

लागत में कमी

 कोसा के फ्लौस हटाने हेतु एक सरल अभिनव उपकरणः यह सरल उपकरण मुड़े हुए एल आकार में लौह छड़ से बना है। सहज संचालन के लिए इसके एक छोर को हाथ से पकड़ने हेतु डिज़ाइन किया गया है। इस उपकरण के जरिए कोसा को प्रत्येक 2'x3' प्लास्टिक ट्रे(या लकड़ी के ट्रे)में आसानी से फ्लौस हटाया जा सकता है।

प्रौद्योगिकी हस्तांतरण

 आदर्श रेशम ग्रामः प्रौद्योगिकी हस्तांतरण की दृष्टि से, देश के पूर्वी तथा उत्तर-पूर्वी क्षेत्रों में चिहिनत 15 आदर्श रेशम ग्रामों में सफलतापूर्वक प्रौद्योगिकी हस्तांतरण क्रियान्वित किया गया। 1210 लाभार्थियों में उनके प्रक्षेत्र स्तर पर अलग-अलग प्रौद्योगिकी पैकेज [वर्षाश्रित: 700 संख्यक, सिंचितः 510 संख्यक] का प्रचार-प्रसार किया गया।

सिंचित अवस्था

- मै.ट/हे/वर्ष की तुलना में 41.43 मै.ट/हे/वर्ष पर्ण उपज दर्ज करने समेत गैर-आदर्श रेशम ग्राम के कृषकों ने 11.3% की लाभ की प्राप्ति की।
- वर्ष के दौरान सिंचित अवस्था के अधीन बहु x द्वि के कुल 1.5 लाख रोमुच का कीटपालन किया गया।
- कोसा उपज 44.2 किग्रा की अपेक्षा 48.7 किग्रा/100 रोमुच दर्ज की गई जो 10.6% की वृद्धि को दर्शाती है।

वर्षाश्रित अवस्था

 गैर-आदर्श रेशम ग्राम स्तर (वृद्धि: 11.5 %) पर 11.52 मीट की तुलना में आदर्श रेशम ग्राम के अधीन 12.85 मै.ट/हे/वर्ष पर्ण उपज दर्ज की गई।

- वर्ष के दौरान वर्षाश्रित अवस्था के अधीन द्वि x द्वि के कुल 74250 रोमुच का कीटपालन किया गया।
- आदर्श रेशम ग्राम के अधीन कोसा उपज 49.2 किग्रा/100 रोमुच दर्ज की गई तथा उपज रेंज 40.4-57.8 किग्रा/100 रोमुच पाई गई।

प्रौद्योगिकी की लोकप्रियता

कुल 670 कृषकों के मध्य चार प्रौद्योगिकियों का प्रचार-प्रसार निदर्शन के माध्यम से लोकप्रिय बनाया गया।

- श्वेत मक्खी प्रबंधन हेतु थायोमेथोक्सम [0.015%] का अनुप्रयोग 150 कृषकों के प्रक्षेत्र में लोकप्रिय बनाया गया जिसके परिणामस्वरुप 7.9 - 12.3 % पर्ण हानि की बचत देखी गई।
- प्रमुख शहतूत पीड़कों के प्रबंधन हेतु येलो स्टिकी ट्रेप्स 250 कृषकों के प्रक्षेत्र में में लोकप्रिय बनाया गया जिसके परिणामस्वरुप बिना ट्रेप 6.56 ट/हे/फसल की तुलना में 7.15 किग्रा उपज देखी गई।
- कुल 150 कृषकों में मृदा परीक्षण आधारित सल्फर उर्वरक का अनुप्रयोग शहतूत प्रक्षेत्र में उत्पादकता तथा गुणवत्ता सुधार हेतु लोकप्रिय बनाया गया। फलतः उपज रेंज में 6.8-10.4 % की वृद्धि दर्ज की गई।
- वर्षाश्रित अवस्था के अधीन नमी बनाये रखने के लिए शहतूत प्रक्षेत्र में 1% पोटेशियम क्लोराइड [जलसंजीवनी] का पर्णीय छिड़काव 100 कृषकों में लोकप्रिय बनाते हुए उपज में 4.7-5.6% की वृद्धि दर्ज की गई।

आईटी पहलः डाटा बेस एवं प्रौद्योगिकी का विकास

- कुल 1349 कृषकों का डाटा बेस तैयार कर "एम-किसान पोर्टल" के माध्यम से 123 संदेशों का संप्रसारण विभिन्न भाषाओं [अर्थात् बंगला, हिंदी, उड़िया, नेपाली, मणिपुरी, खासी एवं अंग्रेजी लिपि] में रेशम फसल की सफलता संबंधी पूर्वसूचना एवं अच्छे कोसे की प्राप्ति हेत् तदविषयक निवारक उपायों को अपनाने के लिए किया गया।
- "रेशम-5के" पोर्टल में कुल 4534 कृषकों का पंजीयन कर फसल-वार डाटा अपलोड किया गया है।
- अनुसंधनात्मक व विकासात्मक गतिविधियों के ई-मॉनिटरिंग हेतु संस्थान के वेबसाइट [www.csrtiber.res.in] पर सभी जारी एवं संपन्न अनुसंधान परियोजनाओं का डाटा अपलोड किया गया है।

- तीन वृत वीडियो अर्थात् श्वेत मक्खी शहतूत की गंभीर पीड़क (बंगला), झारखंड में रेशम कृषि (हिंदी) तथा मेघालय में रेशम कृषि बुनाई हथकरघा की अप्रत्याशित मार्ग प्रशस्त करती है (अंग्रेजी) व प्रसारण हेत् बनाए गए।
- कृषकों में नवीनतम प्रौद्योगिकियों के प्रचार-प्रसार हेतु रेशमकृषि उन्नयन पर 24 संख्यक "रेशम कथा" का प्रसारण आकाशवाणी के माध्यम से करने के साथ ही रेशम कृषि के विकास से जुड़ी 05 एफएम को भी प्रसारित किया गया।
- अंतरराष्ट्रीय गुणवत्ता वाली 2 संख्यक वीडियो अर्थात् टूर टू केरेउअवप्रसं, बहरमपुर एवं मूर्शिदाबाद में रेशम का इतिहास तैयार कर लिया गया है।
- संस्थान द्वारा विकसित प्रौद्योगिकी के पता करने हेतु 8 बार टीवी कार्यक्रम में भाग लिया।
- हाल ही में, विभिन्न भाषाओं में प्रकाशित सभी ब्रोचरों/पैम्फलेट संस्थान के वेबसाइट <u>www.csrtiber.res.in</u> पर अपलोड कर दिया गया है।
- 3 संख्यक रेशम कृषकों की सफल कहानी अर्थात् अनिसुर रहमान युवा रेशम कृषकों के आदर्श, नारी शक्ति रेशम कृषि में सफलता का मार्ग प्रशस्त करती है तथा महिला- रेशम कृषि में महत्वपूर्ण भूमिका अदा करती है प्रकाशित किए गए।
- प्रत्यक्ष लाभ हस्तांतरण (डीबीटी) के अधीन 888 संख्यक कृषकों को कवर किया गया।

विस्तार संचार कार्यक्रम [ईसीपी]

- कृषकों की आवश्यकताओं की पूर्ति एवं प्रक्षेत्र संबंधी किसी भी आगामी समस्या की पूर्व-सूचना देने की एक बहु-आयामी दृष्टि के साथ प्रक्षेत्र स्तर पर विभिन्न विस्तार संसूचना कार्यक्रमों अर्थात् जागरुकता कार्यक्रम, श्रव्य-दृश्य कार्यक्रम, प्रदर्शनी, प्रक्षेत्र निदर्शन आदि का आयोजन किया गया।
- कुल 381 विस्तार संचार कार्यक्रमों द्वारा कुल 21416 हितधारकों को [4 कार्यशाला, 41 जागरुकता कार्यक्रम (2576), 35 प्रक्षेत्र दिवस (1585), 39 प्रक्षेत्र दिवस (1987), 9 प्रदर्शनी (1887), 61 समूह चर्चा (1894), 129 कृषक प्रशिक्षण कार्यक्रम (4590) तथा 8 प्रशिक्षु प्रशिक्षण कार्यक्रम (78) एवं रेशम कृषि मेला / लघु रेशम कृषि मेला (5124)] जानकारी दी गई।

द्विप्रज क्लस्टर प्रवर्धन कार्यक्रम

- पूर्वी और उत्तर-पूर्वी क्षेत्रों के अंतर्गत 8 राज्यों अर्थात पश्चिम बंगाल (4), ओडिशा (2), बिहार (1), असम (3), मणिपुर (2), मिजोरम (1), नागालैंड (1) और त्रिपुरा (1) में पंद्रह द्विप्रज क्लस्टरों का आयोजन सफलतापूर्वक किया गया है।
- कुल 33.1 लाख [द्वि 24.40 लाख व आईसीबी 8.70 लाख] रोमुच के कुल लक्ष्य की तुलना में 34.54 लाख [द्वि 18.29 लाख; आईसीबी 16.25 लाख] रोमुच का कीटपालन किया गया। कुल कोसा उत्पादन 1524.52 टन [द्वि 780.18 टन; आईसीबी 744.34 टन] तथा कच्चे रेशम का उत्पादन 185.58 टन [द्वि 98.59 टन; आईसीबी 86.99 टन] दर्ज करते हुए 181.33 टन के लक्ष्य की तुलना में 2.34% अधि-वृद्धि देखी गई।

मानव संसाधन विकास [एचआरडी]

- भारत के पूर्वी तथा उत्तर-पूर्वी क्षेत्रों में रेशम उद्योग के लाभार्थ रेशम उत्पादन में मानव संसाधन का विकसित किए गए तथा क्षेत्र में रेशम कृषि के सतत विकास के लिए विभिन्न कार्यक्रमों का आयोजन किया गया।
- विभिन्न स्तरों पर रेशम उद्योगों की मानवशक्ति आवश्यकता की पूर्ति के लिए पूर्व एवं कोसोत्तर क्षेत्रों से अलग-अलग राज्य सरकारों / गैर सरकारी संगठनों द्वारा प्रतिनियुक्त नए अभ्यार्थियों से पेशेवर सक्षम मानव संसाधनों की एक स्थिर धारा उत्पन्न करने के उद्देश्य से कुल 13 छात्रों [2016-17 बैच] ने पीजीडीएस पाठ्यक्रम संपन्न किए तथा 20 नए छात्रों ने [2017-18 बैच] कल्याणी विश्वविद्यालय, नदिया [प.बं.] से संबद्ध 15 महीने के पीजीडीएस पाठ्यक्रम में नामंकन करवाएं।
- कुल 3456 प्रशिक्षाणार्थी [384 कृषक निपुणता प्रशिक्षण, 184 प्रौद्योगिकी अभिविन्यास कार्यक्रम, 103 – प्रबंधन विकास कार्यक्रम, 58 – कोसोत्तर प्रौद्योगिकी, 1970 – अन्य प्रशिक्षण कार्यक्रम तथा 847 – आवश्यकता आधारित प्रशिक्षण कार्यक्रम] प्रशिक्षित किए गए।
- संस्थान द्वारा विकसित रेशम कृषि के विभिन्न गतिविधियों जैसे शहतूत कृषि, रेशमकीट पालन प्रौद्योगिकी, रोग व पीड़क प्रबंधन आदि पर कृषकों/प्रतिभागियों को नियमित प्रशिक्षण प्रदान किया गया।
- प्रमुख कृषकों द्वारा रेशम कृषि के अंगीकरण के माध्यम से कृषकों की जानकारी को अद्यतित करने हेतु 3 रेशम संसाधन केन्द्रों बरबकपुर [नदिया], अलीनगर [मालदा] एवं बंकीपुर [मुर्शिदाबाद] में प्रशिक्षण जारी रखते हुए कुल 1235 हितधारक प्रशिक्षित किए गए।

स्वच्छ रेशम ग्राम

- मल्लिकपुर दियारा ग्राम आदर्श स्वच्छ रेशम ग्राम के अधीन अंगीकृत किया गया है।
- कार्यक्रम के क्रियान्वयन हेतु कुल 330 कृषक परिवार अपने आजीविका के प्रमुख स्त्रोत के तौर पर शहतूत रेशम कृषि की खेती [बेसलाइन डाटा की सहायता से] कर रहे हैं।
- कुल 30 स्व-सहायता समूह (एसएचजी) का गठन चाकी कीटपालन, बैठक, अन्य विकास कार्यकलापों आदि जैसे सामूहिक गतिविधियों के निष्पादन हेतु किया गया। जारी अनुकूल जलवायु अवस्था समेत आवश्यक इनपुट एवं प्रौद्योगिकियों के अनुप्रयोग के परिणामस्वरूप अच्छी फसल की प्राप्ति हुई ।
- आदर्श स्वच्छ रेशम ग्राम के अधीन सूचीबद्ध वैयक्तिक कृषकों (330 कृषकों) के लिए अनिवार्य तौर पर बचत बैंक खाते खोलना।

प्रकाशन

- अंतरराष्ट्रीय जर्नलों में 4 शोध पत्र तथा राष्ट्रीय जर्नलों में 12 शोध पत्र प्रकाशित किए गए।
- संस्थान की अर्धवार्षिकी आर एंड डी न्यूज बुलेटिन "न्यूज एंड व्यूज" प्रकाशित किए गए।
- तिमाही रेशम कृषि ब्लेटिन "रेशम कृषि वार्ता" का बंगला भाषा में प्रकाशित की गई।
- संस्थान तथा इसके अधीनस्थ केन्द्रों के वैज्ञानिकों के शोध पत्र सारांश के तौर पर 4 अंतरराष्ट्रीय एवं 9 राष्ट्रीय सम्मेलनों में प्रस्तुत व प्रकशित किए गए।

राजभाषा कार्यान्वयन

- दिनांक 10 मार्च, 2018 को "भारत के पूर्वी तथा पूर्वोत्तर राज्यों" के लिए ज्ञान भवन ऑडिटोरियम गांधी मैदान, पटना में आयोजित क्षेत्रीय राजभाषा सम्मेलन के दौरान समारोह के मुख्य अतिथि माननीय गृह राज्य मंत्री श्री किरण रिजुजु महोदय के कर कमलों द्वारा वर्ष 2016-17 के दौरान राजभाषा नीति के कार्यान्वयन में उत्कृष्ट योगदान के लिए राजभाषा शील्ड अर्थात् द्वितीय पुरस्कार से सम्मानित होने का सुअवसर इस संस्थान को प्राप्त हुआ।
- वर्तमान वर्ष 2017-18 के अंतर्गत राजभाषा कार्यान्वयन समिति की चार बैठकों का नियमित आयोजन क्रमश: दिनांक 27.04.2017, 20.07.2017, 21.10.2017 एवं 12.01.2018 को किया गया तथा बैठक में लिए गए निर्णयों पर अन्वर्ती कारवाई भी की गई।

- तकनीकी तथा प्रशासनिक संवर्ग के अधिकारियों/पदधारियों के लिए राजभाषा के विविध पहलुओं पर क्रमशः 05.04.2017, 18.09.2017, 21.12.2017 एवं 22.03.2018 को हिंदी कार्यशाला आयोजित कर संस्थान के कुल 115 पदधारीगण [अधिकारी - 65 एवं पदधारी – 50] राजभाषा हिन्दी में प्रशिक्षित किए गए तथा आगे भी यह क्रम जारी है।
- रेशम कृषि मेला के अवसर पर "स्कीमनस प्लॉयडिकली चूर्णिल मत्कुण का एक परभक्षी" शीर्षक से एक लीफ्लेट हिंदी भाषा में तथा B.Con.1 x B.Con.4 - एक उज्ज्वल संभावनापूर्ण संकर प्रजाति – नवीन जापानी कीट, ब्रशिंग ऑफ लुज एग, रोग मुक्त कीटपालन के लिए परिशोधन व स्वच्छता एवं टीआर-23 पूर्वी तथा उत्तर-पूर्वी भारत के उष्णकटिबंधीय पहाड़ी अंचल के लिए उपयोगी शहतूत पौध" शीर्षक से चार लीफ्लेट बंगला भाषा में प्रकाशित की गई।
- वर्ष के दौरान नगर राजभाषा कार्यान्वयन समिति, बहरमपुर की 33वीं एवं 34वीं बैठक संस्थान की निदेशक महोदया डॉ. कणिका त्रिवेदी की अध्यक्षता में क्रमशः दिनांक 05.04.2017 एवं 18.09.2017 को अपराहन 3.00 बजे केन्द्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, बहरमपुर के बैठक कक्ष में संपन्न हुई। इस बैठक में राजभाषा विभाग से अनुसंधान अधिकारी (कार्यान्वयन) भी उपस्थित थे जिन्होंने राजभाषा की दिशा में संस्थान तथा नराकास बहरमपुर के सदस्य कार्यालयों को बहुमूल्य सुझाव दिए।

सहयोगात्मक अनुसंधान परियोजनाएं

 शहतूत एवं रेशमकीट उत्पादकता में सुधार हेतु कुछेक सहयोगी अनुसंधान परियोजनाएं प्रतिष्ठित संस्थानों/संगठनों अर्थात् i) एपीएसएसआरडीआई, हिंदुपूर, आन्ध्र प्रदेश, ii) इसरो, एनईएसएसी,मेघालय, iii)एनबीएआईआर, आईसीएआर, बेंगलूर,iv) एनबीएसएस व एलयूपी, आईसीएआर, जोरहाट, v)सीएसजीआरसी, होसूर, तमिलनाडु vi) एसबीआरएल, कोढ़ती, एनएसएसओ, सीएसटीआरआई, बेंगलूर] के साथ जारी रखा गया।

अन्य महत्वपूर्ण उपलब्धि

वर्ष के दौरान आईएसओ 9001:2015 प्रमाणन की मान्यता देने के लिए ॥ जाँच लेखा परीक्षा आयोजित की गई।

क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्र [क्षेरेउअके] की उपलब्धियाँ

क्षेरेउअके, कलिम्पोंग [पश्चिम बंगाल]

- आई. एस. ओ. 9001:2008 प्रमाणन जारी रखा गया।
- वर्तमान कृषि प्रक्रिया (बिना घास मिश्रित गहन जुताई) के तहत शहतूत की वृद्धि की तुलना में घास मिश्रित हल्की जुताई में कृषि प्रक्रिया के अधीन शहतूत की वृद्धि में अधि-उत्पादकता एवं कार्द्र्बन धारिता क्षमता दर्ज की गई।
- मूल चूर्णी मत्कुण की जनसंख्या वृद्धि में अजैविक कारकों जैसे अधिकतम तापमान 29°सें (अगस्त) तथा 30°सें (सितम्बर), अधिकतम आर्द्रता 99% (अगस्त) तथा 97% सहायता करती है।
- द्विप्रज संकरों समेत भारत के पूर्वी तथा उत्तर-पूर्व के प्रतिकूल जलवायू अवस्था के विरुद्ध प्रतिरोधक हेतु आनुवंशिक सुघट्यता के उद्देश्य से इस केन्द्र में 50 द्विप्रज रेशमकीट संकर को शटल प्रजनन में शामिल कर शटल प्रजनन आयोजित किया गया।
- द्विप्रज रेशम कृषि के संवर्धन हेतु कुल SK संकर के कुल 7,320 रोमुच रेशम निदेशालय, सिक्किम को आपूर्ति की गई।
- केन्द्र द्वारा आयोजित प्रशिक्षण कार्यक्रम (TTP: 41 संख्यक, FTP: 101 संख्यक) में कुल 142 प्रतिभागी उपस्थित हुए।
- रेशम कृषि मेला का आयोजन किया गया जिसमें 350 कृषक/हितधारक उपस्थित हुए।
- 10 ईसीपी कार्यक्रम अर्थात् जागरुकता, श्रव्य-दृश्य, प्रक्षेत्र दिवस, समूह चर्चा, प्रौद्योगिकी निदर्शन, आदि का आयोजन किया गया जिसमें 199 जिसमें 350 कृषकों/हितधारकों ने भाग लिए।
- केन्द्र में राजभाषा कार्यान्वयन समिति की चार बैठक क्रमशः दिनांक 03.06.2017, 29.09.2017, 22.12.2017 तथा 19.03.2018 को आयोजित किया गया। साथ ही, दिनांक 05.12.2017 को नराकास की भी एक बैठक का आयोजन किया गया।

क्षेरेउअके, कोरापुट (ओडिशा)

• आई. एस. ओ. 9001:2008 प्रमाणन जारी रखा गया।

- कम उर्वरक मृदा के लिए उपयुक्त शहतूत प्रजाति के मूल्यांकन के दौरान C3 शहतूत प्रजाति में सर्वाधिक पर्ण उपज दर्ज किया गया और इसे 5 साल के लिए अपनाया गया।
- ओडिशा के लिए अधि-झाड़ शहतूत पौधरोपण के अधीन S1635 व C1730 दोनों रेशम संवर्धन 6' x 6' (2.5 व 2.2 ट/फसल/है) तथा 8' x 8' (1.8 व 1.6 ट/फसल/है) अंतराल की तुलना में 5' x 5' के अंतराल पर की गई पौधरोपण में सर्वाधिक पर्ण उपज (2.8 व 2.4 ट/फसल/है) दर्ज की गई।
- द्विप्रज संकर SK-6 x SK-7 के साथ कीटपालन पर जैव आमापन का अध्ययन यह पृष्टि करता है कि C-1 शहतूत प्रजाति सर्वाधिक आर्थिक उपज करता है।
- मृदा में खरपतवारों को सम्मिलित कर प्रक्रियाओं के बदलते पैकेज के साथ-साथ प्रसंस्करण के सामान्य पैकेज में शहतूत की कार्बन धारिता क्षमता का अध्ययन किया गया था। शहतूत के कार्बन धारिता क्षमता (किलो / हेक्टेयर) नियंत्रण की अपेक्षा उपचार में क्रमशः 2536.61 और 2264.36 दर्ज की गई थी।
- टीओटी के अधीन चूने का अनुप्रयोग 1670 किग्रा/हे/वर्ष के खुराक आधार पर किया जाना चाहिए। मृदा में उपलब्ध नमी के साथ बारिश के पश्च CaCO3 के समकक्ष प्रक्षेत्र स्तर पर नियंत्रण की अपेक्षा 30% पर्ण उपज की वृद्धि दर्ज की गई। प्रतिवाष्पोत्सर्जक के अनुप्रयोग (केसीएल): पोटेशियम क्लोराइड का छिड़काव के परिणामस्वरुप अक्टूबर तथा फरवरी फसल के दौरान प्रतिवाष्पोत्सर्जक में नियंत्रण की अपेक्षा उ0% पर्ण उपज की वृद्धि दर्ज की गई। प्रतिवाष्पोत्सर्जक के अनुप्रयोग (केसीएल): पोटेशियम क्लोराइड का छिड़काव के परिणामस्वरुप अक्टूबर तथा फरवरी फसल के दौरान प्रतिवाष्पोत्सर्जक में नियंत्रण की अपेक्षा (5.864 मीट/हे/दो फसल) 5.42% उपज वृद्धि दर्ज की गई। रोगाणुनाशी जैसे चूना, ब्लीचिंग पाउडर, कीटपालन गृह के विसंक्रमण हेतु 2.5% सेनिटेक के उपयोग का निदर्शन किया गया। रेशमकीट को एक साथ परिपक्व करने हेतु बिस्तर रोगाणुनाशी जैसे लेबेक्स, चूना व विजेता तथा संपूर्णा हार्मोन के उपयोग को लोकप्रिय बनाया गया।
- आईटी पहलः संपूर्ण ओडिशा में 110 रेशम कृषकों तक ओडिशा में बोली जाने वाली भाषा ओड़िया में कुल 12 संख्यक संदेश एम-किसान पोर्टल के माध्यम से कृषकों तक संप्रासरित किया गया। तकनीकी आवश्यकताओं को पूरा करने वाले संदेशों को विभिन्न फसल अवधि के दौरान आवश्यकता के अनुसार प्रेषित किया गया था।
- एचआरडीः कुल 17 तक तकनीकी पदधारी टीटीपी के जरिए रेशम निदेशालय, ओडिशा से प्रशिक्षित किए गए तथा ओडिशा एवं छत्तीसगढ़ राज्य से 92 कृषक पांच एफटीपी में प्रशिक्षित किए गए।

- पुरस्कार व मान्यताएः दिनांक 14.05.2017 से 19.05.2017 तक राष्ट्रीय स्तर पर पू पुरी में आयोजित कृषि मेला में भाग लिया। श्री महेश्वर मोहंती, कृषि मंत्री ने प्रदर्शनी का उद्घाटन किया जिन्होंने क्षेरेउअके के प्रदर्शनी स्टॉल की प्रशंसा किए। कुल 389 आगंतुक ने स्टाल का विजिट किया और उन्हें रेशमकीट व रेशम उत्पादन के जीवन चक्र के बारे में जानकारी दी गई। वर्ष 2017-18 के दौरान नगर में स्थित 45 केन्द्र सरकार के कार्यालयों में से केन्द्र द्वारा राजभाषा कार्यान्वयन के क्षेत्र में उत्कृष्ट योगदान करने हेतु नगर राजभाषा कार्यान्वयन समिति, कोरापुट द्वारा प्रथम पुरस्कार से सम्मानित किया गया।
- प्रकाशनः हितधारकों के मध्य रेशम कृषि के प्रचार-प्रसार हेतु तीन लीफ्लेट अर्थात तूत रेशम कृषि, रेशमकीट पालन मार्ग दर्शिका तथा शहतूत खेती एवं रेशमकीट पालन की विभिन्न प्रौद्योगिकी प्रकाशित किए गए।

क्षेरेउअके जोरहाट

- वर्ष 2017-18 में अप्रैल-जून व अक्टूबर के दौरान शहतूत पौध की कार्बन धारिता क्षमता दर्ज की गई। उपचारित पौध नियंत्रण (4952.55 किग्रा/हे/फसल) की तुलना में अधिकतम पर्ण उपज (5117.30 किग्रा/हे/फसल) दर्शाते हैं।
- असम के तीन जिलों के फार्म व कृषक प्रक्षेत्र में तीन प्रमुख पीड़क अर्थात् चूर्णी मत्कुण, श्वेत मक्खी व थ्रिप्स एवं श्वेत मक्खी के 2 प्राकृतिक शत्रु (माइक्रास्पीस डिसकॉलर व सेलोफोरा यूनिकलर) की उपस्थिति दर्ज की गई।
- श्वेत मक्खी के दो वैकल्पिक परपोषी पौधे (मेसुआ फेरा व सीडियम गुवाआ), दो थ्रिप्स (अबेलमोसखस एसकुलेंटस एवं कैप्सीकम एनम) तथा तीन चूर्णी मत्कुण (केरिका पपाया, हिबिसकस रोसा चिंनेसिस, सोलानम मेननजिना) दर्ज की गई।
- क्षेरेउअके जोरहाट तथा इसके अधीनस्थ इसके इकाइयों द्वारा मिश्रित सतही मृदा के कुल 1545 [असम (130), शिलांग (300), मंगलदोई (400), आईजोल (698) एवं मणिपुर (17)] नमूने संग्रहित किए गए तथा अविके, इम्फाल ने 456 मृदा नमूने का विश्लेषण किया एवं मणिपुर के संबंधित कृषकों को 220 मृदा स्वास्थ्य कार्ड संवितरित किए।
- प्राधिकरण परीक्षण के अधीन दो ऋतुओं में उत्तर-पूर्वी राज्यों के 519 कृषक द्वारा B.Con .1 x B. Con 4 के 0.308 लाख रोमुच कीटपालित किए गए। औसत कोसा उपज/100 रोमुच 46.72किग्रा/100 रोमुच पाई गई।
- उत्तर-पूर्वी राज्यों में वाणिज्यिक फसल ऋतु के दौरान प्रक्षेत्र स्तर पर शहतूत रेशमकीट रोग के आपतन अर्थात् ग्रैसरी, फ्लेचरी एवं मस्करडाइन दर्ज की गई।

- सीएसजीआरसी, होसूर से बीस (20) शहतूत एक्सेशन संग्रहित कर क्षेरेउअके, जोरहाट में उपज की गई। MI-0110 (93.33%) के पश्चात MI-0149 (100%) में अधिकतम उत्तरजीविता प्रतिशत पाई गई।
- जननद्रव्य भू-खंड के अधीन संवर्धन प्रचालन का पालन कर तेईस (23) एक्सेशन का रख-रखाव किया जा रहा है। उक्त एक्सेशनों में से MI-0349 (11.21 मीट/हे/वर्ष) में अधिकतम पर्ण उपज दर्ज की गई तथा यह S1635 (11.15 मीट/हे/वर्ष) के बराबर था। MI-0349 का कीटपालन प्रदर्शन SCW, SSW, SR% तथा उपज/100 रोमुच के तुलना में बेहतर था।
- सितम्बर, 2017 के दौरान 10 आशाजनक शहतूत एक्सेशन अर्थात् C2, C1, C5, C9, S1635, C11, C45, C108, C121, C384 संस्थापित किए गए।
- भारत के पूर्वी तथा उत्तर-पूर्वी क्षेत्रों (चरण II) के अत्याधिक अस्थिर एवं मौसम के अनुरुप परिवर्तनशील जलवायु अवस्था के लिए उपयुक्त क्षेत्र विशिष्ट द्विप्रज संकर की पहचान की गईः दस आशाजनक संयोजन में से 4 लाइनों ने शरद, 2017 के दौरान अन्य की तुलना में अधिकतम कोसा उपज पाया गया । ये लाइन हैं JOR 1 x JOR6 (ERR-7883 संख्यक), JOR 1 x JOR10 (ERR-8033 संख्यक), BHP 4 x BHP10(ERR-7800 संख्यक), BHP 4 x BHP9(ERR-7316 संख्यक)।
- शरत ऋतु, 2017 के दौरान बहु x द्वि संकरों अर्थात् 8W x (SK6 xSK7), 21Y (B.Con.1 x B.Con. 4), 12 Y (B.Con.1 x B.Con. 4) तथा N(P) x (SK6 x SK7) के कीटपालन प्रदर्शन की जांच की गई। चार एक्सेशनों में से 8W x (SK6 x SK7) अन्य की त्लना में अधिकतम कोसा उपज 42 किग्रा/100 रोम्च दर्शाता है।
- टीओटी कार्यक्रमः कुल 770 कृषकों को अंगीकृत कर वर्ष 2017-18 के दौरान 84500 रोमुच कीटपालित किए गए। तीन रेशमकीट नम्लें अर्थात् SK6 x SK7, B. Con. 1x B. Con. 4 and FC-1 x FC-2 की जांच की गई। संपूर्ण उत्तर-पूर्वी राज्यों में B. Con.1 x B. Con. 4 ने 49.93 किग्रा/100 रोमुच उपज के साथ बेहतर उपज दर्शाया है। राज्य की औसत कोसा उपज 49.93 किग्रा/100 रोमुच है जबकि SK6 x SK7 44.65 किग्रा उपज दर्शाया है। दूसरी ओर FC1 xFC2 केवल त्रिपुरा में कोसा उपज (57.80 किग्रा/ 100 रोमुच) दर्शाता है।
- एचआरडी कार्यक्रमः प्रशिक्षु प्रशिक्षण कार्यक्रम के अधीन रेशम निदेशालय, जोरहाट व गोलाघाट के 10 पदधारी प्रशिक्षित किए गए। कृषक प्रशिक्षण कार्यक्रम का आयोजन कर 2341 कृषक को सुग्राहित कर नवीनतम पौद्योगिकी में प्रशिक्षित किए गए।

- बीभी-सीपीपीः उत्तर-पूर्वी राज्यों में 8 विभिन्न क्लस्टरों में एचवाईवी शहतूत के कुल 3304 एकड़ का रख-रखाव किया जा रहा है। 67 संख्यक विस्तार संसूचना कार्यक्रम के माध्यम से कुल 2733 कृषक सूग्राहित किए गए। इसके अलावा, तीन ऋतुओं में उक्त क्लस्टरों में 10.255 लाख रोमुच कीटपालित कर प्रति 100 रोमुच 45.55 किग्रा कोसा का उत्पादन किया गया तथा अवधि के दौरान 53.83 कच्चा रेशम उत्पादित किया गया।
- एचवाईवीः अधि उपज शहतूत प्रजातियों S-1635 के साथ 75 किसानों द्वारा कुल 47.00 एकड़ जमीन पर शहतूत कृषि का विस्तार किया गया तथा अधि उपज शहतूत प्रजाति S-1635 की 64000 पौध की पैदावार की गई।
- विस्तार संसूचना कार्यक्रम (ईसीपी): कुल 111 ईसीपी अर्थात् जागरुकता कार्यक्रम, प्रक्षेत्र दिवस, श्रव्य-दृश्य, प्रदर्शनी, समूह चर्चा, प्रौद्योगिकी निदर्शन, रेशम कृषि मेला-सह-प्रदर्शनी कार्यक्रम का आयोजन कर 11478 कृषक सुग्राहित किए गए।
- श्वेत मक्खी प्रबंधन हेतु येलो स्टिकी ट्रेप्स को लोकप्रिय बनाया गयाः श्वेत मक्खी के नियंत्रण में येलो स्टिकी ट्रेप्स को प्रभावी पाया गया। चूंकि यह 3.7 किलोग्राम के नियंत्रण की तुलना में 4.2 / हेक्टेयर/फसल पर्ण उपज दर्शाने के साथ ही साथ पर्ण उपज में 15.77% वृद्धि दर्ज की गई।
- श्वेत मक्खी प्रबंधन हेतु थायोमेथाक्सम को लोकप्रिय बनाया गयाः कृषक स्तर पर शहतूत बगीचे में थायोमेथाक्सम का छिड़काव भू-खंड के नियंत्रण (3.57 ट/हे/फ्सल) की तुलना में बेहतर पर्ण उपज (4.15 ट/हे/फ्सल) अर्थात् 16.25 टन दर्शाता है।
- प्रकाशनः क्षेरेउअके जोरहाट तथा इसके अधीनस्थ केन्द्रों द्वारा 3 तकनीकी रिपोर्ट,
 27 पुस्तिका व लीफ्लेट, 7- समाचार पत्र रिपोर्ट प्रकाशित किए गए तथा 5 टीवी/रेडियो संवाद में भी भाग लिए।
- अन्य कार्यक्रमः क्षेरेउअके, जोरहाट में दिनांक 21.02.2018 को "रेशम उत्पादन में चाकी कीटपालन केन्द्रों की भूमिका" शीर्षक पर एक संगोष्ठी का आयोजन किया गया।



1.b. EXECUTIVE SUMMARY

Central Sericultural Research and Training Institute, Berhampore along with its nested 03 (three) Regional Sericultural Research Stations (RSRSs) and 13 (thirteen) Research Extension Centers (RECs) have made significant contributions for the development of sericulture industry in the Eastern and North Eastern regions. The Research & Development focus was mainly on prioritized need of regional requirements, extension and human resource development for benefiting the sericulture stakeholders in close coordination with Directorates of Sericulture / Industries in Eastern (5) and North Eastern (8) states.

Since a long, West Bengal along with the Eastern part of the country were known as non-congenial zone for bivoltine sericulture due to climatic hazards but overcoming all the hazards, bivoltine sericulture has gained momentum in the region due to tireless efforts of extension machineries.

During the period, 36 research projects and programmes (29 Projects, 1 Pilot Study and 6 Prog.) were continued for addressing problems in various aspects of sericulture industry. Moreover, during the year, a total of 11 Projects, 1 Pilot Study and 1 Programmes were concluded and 8 projects & 4 programmes were initiated.

Major achievements made during the year 2017-18 are as follows:

MULBERRY IMPROVEMENT & PRODUCTIVITY

- Identified a high yielding mulberry genotype, C-9 suitable for low input soil condition with annual leaf yield of 49.89 & 34.01 t/ha/yr. under full and half of NPK dose, respectively, compared to check S-1635 (44.13 & 26.84 t/ha/yr., respectively).
- Identified thirty (30) mulberry promising genotypes under moisture stress condition that can yield better than the existing rainfed varieties with significantly higher annual leaf yield (>1.963kg/ plant) over C-2038(1.88 kg/yr.) along with better physiological traits *viz.*, specific leaf area (<250 g cm⁻²), chlorophyll content (>15 μ gcm²), leaf size (>150 cm²) and moisture content (>75%).
- Application of seaweed extract (*Ascophyllum nodosum* @ 0.5 ml/L) sprayed at 21 and 28 days after pruning, at 60th day increased leaf yield (11 %) compared to control S-1635 (328.33 g/plant) (average of 30 plants).
- The moderate tillage with grass cover registered carbon capturing of ~ 9% improvements (632 kg/ha/crop) as compared to intensive tillage without grass cover (576 kg /ha/crop).

- During the period, 5640 Soil Health Cards distributed and 1144 SHCs are ready for distribution.
- Regarding evaluation of solar pump based low cost drumkit and pressurized drip tape fertigation systems, Maximum leaf yield of 528 g/plant (3'×3') and 255 g/plant (2'×2') recorded under drip tape fertigation with 100% RDF and showed 34% and 19%, respectively higher leaf yield than surface irrigation with soil application of 100 % RDF (395 & 214g/plant, respectively) of S-1635 variety.
- At **RSRS**, Jorhat, 23 accessions are being maintained at germplasm plot where maximum leaf yield was recorded in **MI-0349** (11.217 t/ha/yr.) and **MI-879** (10.956 t/ha/yr.) was significantly higher which can be utilized as a genetics resource materials.

MULBERRY PROTECTION

- Survey and surveillance of the pests of mulberry, forewarning as well as remedial measures are extended through message "*m-kisan* portal" for the direct benefit of the sericulture stakeholders.
- Regards assessment of promising powdery mildew resistance lines, two promising lines exhibited ~ 17-29% more leaf biomass than S-1635 (44-45 t/ha/yr.) out of which C-1360 selected for AICEM-IV phase trial by MVAC (2018-2023). Tested ~30 PM specific putative markers on three generations of segregating progeny with phenotyping. Two allelic bands of 182bps (MM68) and 190bps (MM128) showed very strong correlation with phenotypic disease reaction.
- Under assessment of promising bacterial leaf spot (BLS) resistant lines two of the promising lines exhibited ~ 9-16% more leaf biomass than C-2038 (50-53 t/ha/yr.).
- Under population interaction of pest and natural enemies in mulberry ecosystem, major mulberry pests and their alternate hosts and natural enemy complex in relation to abiotic factors were documented and popularized for awareness among farmers.
- Regarding incidence of whitefly in mulberry germplasm accessions, out of 154 mulberry accessions, 10 were found to be relatively tolerant (1-4 nos. per leaf) to whitefly incidence which will be useful in mulberry breeding for whitefly resistance.

SILKWORM IMPROVEMENT AND PRODUCTIVITY

- Two new hybrids namely **HTH3** × **HTH6** and **HTH4** × **HTH9** were found to be tolerant (>65%) to high temperature and high humidity of $35 \pm 1^{\circ}$ C & $85 \pm 5^{\circ}$ % conditions.
- Two new bivoltine single hybrids namely, **BHP-2 x BHP-8** and **BHP-3 x BHP-8** are developed through shuttle breeding approach (AIB:3617), which are excelling over SK6 x SK7 and B. Con.1 x B. Con.4, in productivity merits such as Shell percentage (5 -10%), while the fitness merits are on par.
- One new Bi x Bi hybrid- **B.Con.1 x B.Con.4** with control SK6 x SK7 and one new Multi x Bi hybrid-**M6DPC x (SK6 x SK7)** with control N x (SK6 x SK7) *have been authorized for eastern & north-eastern states by Hybrid Authorization Committee held on 19.02.2018.*
- Five breeds viz., 1. M.Con.4^{Id} (Pseudo pigmented Diapause Inhibitor Yellow Oval shaped cocoon), 2. M.Con.4^{Id} (Non pseudo Diapause Inhibitor Yellow Oval shaped cocoon), 3. M.Con.4^{Id} (Pseudo Pigmented Butter Colour Cocoon), 4. B.Con.4^{Id} (Pseudo Pigmented Butter Colour Cocoon) and 5. BHB ^{Id} (Pseudo Pigmented White Colour Oval & Dumbbell) with Id character has been developed. Two breeds has been utilized for making bi x multi dfls with hatching of more than 90% has been observed without acid treatment like multi x bi dfls. Large scale trial of these bi x multi hybrids will be undertaken as soon as possible.
- During the period 6080 P_1 dfls have been supplied to different states and organizations and 0.97 lakh hybrid dfls to 600 farmers under Authorization trial.

SILKWORM PROTECTION

- To screen the efficacy of phototrophic bacterial extracts as feed supplements for disease management in silkworm, three bacterial strains belonging to the genera *Rhodovulum*, *Rhodobacter & Rhodopseudomonas* was carried out. The efficacy of the feed supplements employing all the above three bacterial cultures independently at different doses were also carried out. Based on the bioassay studies conducted with 4 breeds and 1 hybrid (M.Con.1 x B.Con.4, SK-6, SK-7, B.Con.1 and B.Con.4), no toxic effect of the feed supplement have been found and without any substantial difference in the survival, cocoon shell weight and filament length.
- For isolation, purification and characterization of antibacterial protein fractions elicited against bacterial strain, Full length cloning of lipoprotein gene was carried out by 5' and 3' RACE and sequence confirmed. The lipoprotein gene was cloned in *Pichia pastoris* for its recombinant expression. The transformed



Pichia pastoris was subjected to liquid culture in selective medium and cell pellets and supernatants were collected at different time intervals. Proteins were extracted from both cells and supernatants. The recombinant expression of the protein will be confirmed by SDS-PAGE, western blot using anti histidine antibody, followed by antibacterial assay.

- The thermo-tolerance abilities of 11 bivoltine breeds were tested on the basis of survival, pupation and reactive oxygen species (ROS) stabilisation abilities under the regime of 35°C with 75% RH against the control of 25°C. Three breeds (B.Con.4 > B.Con.1 > BHR-3) showed thermo-tolerance on the basis of survival and superoxide dismutase (SOD) activity.
- Routine survey during Commercial crops (849 samples) have been done and suggested preventive/ remedial measures to minimize/ control the crop loss due to diseases are regularly being advised to the stakeholders. Meteorological data is also regularly being collected and updated and the same will be correlated with silkworm disease incidence. During Baisakhi (April) crop gattine 6.8% (3.9 11.5%) was prevalent, Jaitha (May-June) & Bhaduri (August) crop grasserie was reported 7.1 to 7.3%. During Seed Crops (373Isamples) 3731 samples collected from 91 villages/DoS farms of WB, Jharkhand and Odisha. Grasserie reported 5.85 %. In NE Region 329 samples collected from 60 villages of 7 states (Assam, Manipur, Nagaland, Tripura, Mizoram, Meghalaya and Sikkim) and found Grasserie prevalent during June-July'17 crop.

COST REDUCTION

★ A Simple Innovative Tool for cocoon deflossing: This simple tool is made up of iron rods in tweaked L shape. One end is designed to hold the hand for easy operation. With this tool cocoons in each 2' x 3' plastic trays (or wooden tray) can be easily deflossed.

TECHNOLOGY TRANSFER

Seri Model Villages: With an eye towards transfer of technology efficiently, 15 Seri Model Villages were identified and there upon implemented in Eastern and Northeastern region of the country. Separate technology packages (*Irrigated*: 700 nos; *Rainfed*: 510 nos) were disseminated among 1210 beneficiaries at their filed level.

Irrigated conditions:

- ✓ The leaf yield recorded with the *Seri Model Village* farmers was 41.43 mt/ha/yr against 37.23 mt/ha/yr with the non-SMV farmers, registering a gain of 11.3 %.
- ✓ A total of 1.5 lakhs dfls of M x B were reared under irrigated conditions during the year.

✓ The cocoon yield recorded was 48.7 kg/100 dfls against 44.2 kg, reflecting a gain of 10.6 %.

Rainfed conditions:

- ✓ Under SMV, the leaf yield recorded was 12.85 mt/ ha/yr against 11.52 mt at non-SMV level (Enhancement: 11.5 %).
- ✓ A total of 74250 dfls of B x B were reared under rainfed conditions during the year.
- ✓ The cocoon yield under SMV recorded was 49.2 kg/100 dfls and the yield range observed was 40.4-57.8 kg/100 dfls.
- Popularization of technologies: Four technologies were popularized through demonstration among 670 farmers.
- Application of *Thiamethoxam* (0.015%) for whitefly management covered 150 farmers' field, the results reflecting saving of leaf loss by 7.9 12.3 %.
- Yellow sticky traps for the management of major mulberry pests covered 250 farmers' field which resulted in yield of 7.15 kg against 6.56 t/ha/crop without trap.
- Application of *soil test based Sulphur fertilizer* in mulberry field for productivity and quality improvement, covered 150 farmers and observed yield gain range of 6.8-10.4 %.
- Foliar application of 1% Potassium Chloride (Jalsanjeevini) in mulberry field under rainfed condition for moisture retention covered 100 farmers and observed yield gain of 4.7-5.6%.

> IT Initiatives: Development of data base and technology

- A total of 1349 farmers' database created and 123 messages in different languages (*viz.* Bengali, Hindi, Oriya, Nepali, Manipuri, Khasi in English script) had been sent through the *m Kisan* portal to forewarn and take preventive measures for good harvest of cocoons.
- In "Seri-5k" Portal, a total of 4534 farmers were enrolled and up-loaded the crop-wise data.
- All the on-going and concluded research projects (24 Nos.) uploaded in the institute website (*www.csrtiber.res.in*) for *e-monitoring* of R&D activities.
- **Three documentary videos** viz. Whitefly A severe pest of mulberry (Bengali), Sericulture in Jharkhand (Hindi) and Sericulture weaving leads way to untapped potential of handloom in Meghalaya (English) were prepared for telecasting.
- 24 number of "**Resham Katha**" on sericulture improvement through All India radio has been broadcasted for dissemination of modern technologies for the farmers and 05 FM Broadcasting has been aired for sericulture development.



- 2 nos Video of International quality has been prepared viz. Tour to CSR&TI, Berhampore & History of Silk in Murshidabad.
- 8 times participated in TV programmes to explore the technologies developed by the institute.
- All brochures/ pamphlets published recently in different vernaculars had been uploaded in the institute website <u>www.csrtiber.res.in.</u>
- 3 nos. success stories viz. Anisur Rahaman- A role model of young sericulturist, Women power shows the way to success in sericulture and Women- a major player in sriculture, have been published.
- 888 numbers of farmers were covered under Direct Benefit Transfer (DBT).

EXTENSION COMMUNICATION PROGRAMMES (ECP)

- Different ECPs *viz.*, Awareness programmes, Audio-visual prog., Exhibition, Field demonstrations etc. have been organized at the farmers' level with a multifold approach of dissemination of farmer friendly technologies, catering to the farmers' needs and also pre-warning the farmers of any upcoming field problem.
- A total of 21416 stake holders were sensitized through 381 extension communication programmes, [4- Workshops, 41- Awareness prog. (2576), 35-Farmers Day (1585), 39- Field days (1987), 9-exhibitions (1887), 61- Group Discussions (1894), 129- Farmers Training Prog. (4590) and 8 Trainers Training Prog. (78) and 17 Resham Krishi Melas / Mini RKMs/ (5124)].

BIVOLTINE CLUSTER PROMOTION PROGRAMME

- Fifteen Bivoltine clusters at West Bengal (4), Odisha (2), Bihar (1), Assam (3), Manipur (2), Mizoram (1), Nagaland (1) and Tripura (1) have been successfully organized in 8 states under Eastern & NE zones.
- Against a total target of 33.1 lakh (Bv. 24.40 lakh & ICB 8.70 lakh) dfls, 34.54 lakh (Bv. 18.29 lakh; ICB 16.25 lakh) dfls were reared (Achievement 104.35%). Total cocoon production was 1524.52 t (Bv. 780.18 t; ICB 744.34 t) and raw silk production was 185.58 t (Bv. 98.59 t; ICB 86.99 t) which was 2.34% higher over target of 181.33 t.

HUMAN RESOURCE DEVELOPMENT (HRD)

- To develop human resource in sericulture for benefit of the Silk industry in E & NE states of India various programmes were organized for sustainable development of sericulture in the regions.
- 13 students (2016-17 batch) completed and 20 new students (2017-18 batch) have joined in the 15 months PGDS course affiliated to the University of Kalyani, Nadia (W.B.) to generate a steady stream of professionally competent human resources from the fresh candidates deputed by different state



Governments/ NGOs in both pre and post cocoon sectors for meeting the manpower requirement of the sericulture industries at various levels.

- A total of **3546** candidates were trained [**384** -Farmers' Skill Training, **184** Technology Orientation Programme, **103**-Management Development Programme, **58** -Post Cocoon Technology, **1970** -Other Training Programme and **847** -Need based Training programme].
- Regular training was imparted to the farmers/ participants on different activities of sericulture, such as mulberry cultivation, silkworm rearing technologies, disease and pest management etc. developed by the Institute.
- To upgrade the knowledge of the farmers through adopted sericulture lead farmers, continued training programme on the 3 **Seri Resource Centres** at Barbakpur (Nadia); Alinagar (Malda) and Bankipur (Murshidabad) and 1235 stakeholders have been sensitized.

SWACHHA RESHAM GRAM

- Mallikpur-Diara village has been adopted under Adarsh Swachha Resham Gram.
- A total of 330 families practicing mulberry sericulture as their major livelihood in for implementing programme.
- 30 Self Help Group (SHGs) formed for taking group activities like Chawki rearing, meeting, other development activities meeting, etc. Necessary inputs & the application of technologies along with the ongoing congenial climatic conditions, a good crop harvest resulted.
- Compulsory opening of savings bank account for the individual farmers (330 farmers), enlisted under Adarsh Swachh Resham Gram.

PUBLICATIONS

- Four research papers published in International Journals and twelve research papers published in National Journals.
- A half-yearly Institute's R&D news bulletin -News & Views were published.
- Resham Krishi Barta a quarterly sericulture news bulletin in Bengali were published.
- Papers of the scientist of the institute and nested units are presented and published abstracts in the International (4 nos.) and national (09 nos.) conferences.

OFFICIAL LANGUAGE IMPLEMENTATION

- दिनांक 10 मार्च, 2018 को "भारत के पूर्वी तथा पूर्वोत्तर राज्यों" के लिए ज्ञान भवन ऑडिटोरियम गाँधी, मैदानपटना, में आयोजित क्षेत्रीय राजभाषा सम्मेलन के दौरान समारोह के मुख्य अतिथि माननीय गृह राज्य मंत्री श्री किरणरिज्जू महोदय के कर-कमलों द्वारा वर्ष 2016-17 के दौरान राजभाषा नीति के कार्यान्वयन में उत्कृष्ट योगदान के लिए राजभाषा शील्ड अर्थात् द्वितीय पुरस्कार से सम्मानित होने का सुअवसर इस संस्थान को प्राप्त हुआ।
- वर्तमान वर्ष 2017-18 के अंतर्गत राजभाषा कार्यान्वयन समिति की चार बैठकों का नियमित आयोजन क्रमश: दिनांक 27.04.2017, 20.07.2017, 21.10.2017 एवं 12.01.2018 को किया गया तथा बैठक में लिए गए निर्णयों पर अनुवर्ती कारवाई की गई।
- तकनीकी तथा प्रशासनिक संवर्ग के अधिकारियों/पदधारियों के लिए राजभाषा के विविध पहलुओं पर क्रमशः 05.04.2017, 18.09.2017, 21.12.2017 एवं 22.03.2018 को हिंदी कार्यशाला आयोजित कर संस्थान के कुल 115 पदधारीगण [अधिकारी - 65 एवं पदधारी - 50] राजभाषा हिन्दी में प्रशिक्षित किए गए तथा आगे भी यह क्रम जारी है।
- रेशम कृषि मेला के अवसर पर" स्कीमनस प्लॉयडिकली चूर्णिल मत्कुण का एक परभक्षी "शीर्षक से एक लीफ्लेट हिंदी भाषा में तथा "B.Con.1 x B. Con.4 -एक उज्ज्वल संभावनापूर्ण संकर प्रजाति - नवीन जापानी कीट", "ब्रशिंग ऑफ लुज एग", "रोग मुक्त कीटपालन के लिए परिशोधन व स्वच्छता" एवं "टीआर-23 पूर्वी तथा उत्तर-पूर्वी भारत के उष्णकटिबंधीय पहाड़ी अंचल के लिए उपयोगी शहतूत पौध "शीर्षक से चार लीफ्लेट बंगला भाषा में प्रकाशित की गई।
- इस वर्ष के दौरान नगर राजभाषा कार्यान्वयन समिति की 33वीं बैठक दिनांक 05.04.2017 तथा दिनांक 18.09.2017 को 34वीं बैठक संपन्न की गई। समिति के प्रयास से नगर स्थित केन्द्रीय सरकार के कार्यालयों/ बैंकों/ निगमों/ उपक्रमों/ संगठनों आदि में भी राजभाषा गतिविधियां बढ़ी है।
- इसके अतिरिक्त नगर के सदस्य कार्यालय अ ,अपने कार्यालयो में हिन्दी दिवस-संगोष्ठी कार्यशाला एवं बैठकों का आयोजन कर रहे है। समिति की ,प्रतियोगिता

राजभाषा कार्यान्वयन संबंधी उक्त गतिविधियों के संचालन से संस्थान में कार्**यमात्रा में भी अत्याधिक वृद्धि हुई है।**

COLLABORATIVE RESEARCH PROJECTS:

• A few number of collaborative research projects were continued with the reputed Institutes / Organizations for the improvement of mulberry and silkworm productivity *viz.*, i) APSSRDI, Hidupur, Andhra Pradesh, ii) ISRO, NESAC, Meghalaya, iii) NBAIR, ICAR, Bangalore, iv) NBSS&LUP, ICAR, Jorhat, v) CSGRC, Hosur, Tamil Nadu, vi) SBRL, Kodathi, NSSO, CSTRI, Bangalore.

OTHER SIGNIFICANT ACHIEVEMENT

• During the year, 2nd Surveillance audit for accreditation of **ISO 9001:2015** was conducted.

ACHIEVEMENTS OF REGIONAL SERICULTURAL RESEARCH STATION (RSRSs)

RSRS, Kalimpong (West Bengal)

- ✤ Continued with ISO 9001: 2008 certification.
- Mulberry growing under the farming practice, moderate tillage with grass cover, registered higher productivity and carbon capturing potential in comparison to that of mulberry growing under existing farming practice (intensive tillage without grass cover).
- The abiotic factors like maximum temperature of 29°C (Aug.) and 30°C (Sept.), maximum humidity of 99% (Aug.) and 97% (Sept.) helped in population buildup of root mealy bug.
- Shuttle breeding involving 50 bivoltine silkworm hybrids (25 each of Berhampore and Kalimpong lot) had been conducted this station with an object to identify bivoltine hybrids with genetic plasticity to buffer against the adverse climatic conditions of Eastern and North-Eastern India.
- ✤ A total of 7,320 dfls of SK hybrids were supplied to DoS, Sikkim for promotion of Bivoltine sericulture.
- ✤ A total of 142 participants have attended the training programmes (TTP: 41 nos, FTP: 101 nos.) organized by the station.
- Organized Resham Krishi Mela with 350 farmers / seri-stakeholders.

- Organized 10 ECP prog. viz. Awareness, Audio-visual, Field day, Group discussion, Technology demonstration, etc. with the participation of 199 farmers / seri-stakeholders.
- ✤ Four OLIC meetings on 03.06.2017, 29.09.2017, 22.12.2017 and 19.03.2018 and 01 TOLIC meeting on 05.12.2017 was conducted at this station.

RSRS, Koraput (Odisha)

- ✤ Continued with ISO 9001: 2008 certification.
- The highest leaf yield recorded was in C3 mulberry variety during evaluation of mulberry varieties suitable for low fertile soils" was taken up for a period of 5 years.
- Under high bush mulberry plantation for Odisha, both S1635 & C1730 cultivars with a spacing of 5' x 5' recorded highest leaf yield (2.8 & 2.4 t/crop/ha) as compared to 6' x 6' (2.5 & 2.2 t/crop/ha) and 8' x 8' (1.8 & 1.6 t/crop/ha) spacing.
- The bioassay studies on rearing with Bivoltine hybrid, SK-6 x SK-7 conferred that C-1 mulberry variety yielded highest economic characters.
- Carbon capturing potential of mulberry was studied in normal package of practices vis-à-vis altered package of practices by incorporation of weeds in the soil. The Carbon capturing potential (kg/ ha yr.) of mulberry was recorded to be 2536.61 and 2264.36 in treatment in control respectively.
- Under TOT, application of lime at the dose of 1670kg/ha/yr. CaCO₃ equivalent during post rains with the availability of moisture in the soil recorded leaf yield gain of 30% over control at farmers level. Application of antitranspirant (KCl): Spray of Potassium Chloride –an antitranpirant during the October and February crops recorded an yield gain of 5.42% over control (5.864 mt/ha/ two crops). Demonstrated use of Disinfectants like lime, Bleaching powder, 2.5% Sanitech for disinfection of the rearing houses. Popularized use of bed disinfectants like Labex, lime & Vijetha and use of Sampoorna harmone for uniform ripening of silk worm.
- ✤ IT initiatives: A total of 12 nos of messages have been transmitted through *m*-kissan portal to the farmers in the colloquial Odia language to reach 110 sericulture farmers throughout odisha. The messages meeting the technical requirements were transmitted as per need during different crop periods.



- HRD: A total of 17 technical personnel were trained from DOS, Odisha through TTP and 92 farmers were trained in five FTP from the states Odisha and Chhatisgarh.
- Awards and Recognitions: Participated in the National Level Krishimela conducted at Puri from 14.05.2017 to 19.05.2017. Shri Maheswara Mohanty, Agriculture Minister inaugurated the exhibition who appreciated RSRS's Exhibition stall. A total of 389 visitors visited the stall and were enlightened about lifecycle of silkworm and silk production. Received first prize in the Implementation of Office Language Hindi in Koraput circle through "Nagar Raj Bhaasha Karyaanvayana Samiti" for 2017-18 among 45 no. of Central Government organizations.
- Publication: Three leaflets published in vernacular language for dissemination among the stakeholders: Tuta Resham Chasha, Resham keeta paalan marg darshika and Sahatoot kheti ebang Resham keet paalan ki bibhinna pradyogiki.

RSRS, Jorhat

- Carbon capturing efficiency of mulberry plant was recorded during April, June and October during 2017-18. Treated plants show maximum leaf yields (5117.30 kg/ha/crop) than control (4952.55 kg/ha/crop).
- Three major pests viz., mealy bug, white fly & thrips and 2 natural enemies of white fly(*Micraspis discolor & Celophora unicolor*) were recorded from the farm & farmers' fields in 3 districts of Assam.
- ✤ Two alternative host plants of white fly (Mesua ferrea & Psidium guwava), two thrips (Abelmochus esculentus and Capsicum annuum) and three mealy bugs (Carica papaya, Hibiscus rosa-sinensis, Solanum melongena) were recorded.
- ✤ A total of 1545 [Assam (130), Shillong (300), Mongaldoi (400), Aizwal (698) and Manipur (17)] composite surface soil samples were collected by RSRS, Jorhat and its nested units and REC, Imphal analyzed 456 soil samples and 220 Soil Health Cards distributed towards the respective farmers of Manipur.
- Under Authorization Trial, 0.308 lakhs dfls were reared by 519 farmers of North Eastern states with B.Con .1 x B. Con 4 in two seasons. Average cocoon yield /100 dfls was observed as 46.72/100 dfls.
- Incidence of mulberry silkworm diseases viz., Grasserie, Flacheries and muscardine were recorded at farmers' level during commercial crop season in NE states.

- Twenty (20) mulberry accessions were collected from CSGRC, Hosur and raised at RSRS, Jorhat. Maximum survival percentage was observed in MI-0149 (100%) followed by MI-0110 (93.33%).
- Twenty three (23) accessions were being maintained by following cultural operations under germplasm plot. Among the accessions maximum of leaf yield was recorded in MI-0349 (11.21 mt/ha/yr.) and it was at par with S1635 (11.15 mt/ha/yr.). The rearing performance of MI-0349 was better in respect of SCW, SSW, SR% and yield / 100 dfls
- Established 10 promising mulberry accessions viz. a C2, C1, C5, C9, S1635, C11, C45, C108, C121, C384 during Sept., 2017.
- ✤ Identification of region specific bivoltine hybrids suitable for highly fluctuating and seasonally variable climatic conditions of Eastern and North eastern India (Phase-II) : Among the ten promising combinations, 4 lines shows maximum cocoon yield over the others during Autumn,2017. These lines are i.e, JOR1 x JOR6 (ERR-7883 nos.) JOR1 x JOR10 (ERR-8033 nos.), BHP 4 x BHP10 (ERR-7800 nos.), BHP4 x BHP9 (ERR-7316 nos.).
- Rearing performance of four multi x bi hybrids viz., 8W x (SK6 xSK7), 21Y (B.Con.1 x B.Con. 4), 12 Y (B.Con.1 x B.Con. 4) and N(P) x (SK6 x SK7) were tested during Autumn, 2017. Among the four accessions, 8W x (SK6 x SK7) shows maximum cocoon yield, 42kg/100 dfls over others.
- TOT Programme: A total of 770 farmers were adopted and 84500 dfls were reared during 2017-18. Three silkworm breeds *i.e.*, SK6 x SK7, B. Con. 1x B. Con. 4 and FC-1 x FC-2 have been tested. B. Con.1 x B. Con. 4 shows better yield in all N.E. States with average of 49.93 kg/100 dfls. While, SK6 x SK7 shows 44.65 kg. On the Other hand FC1 xFC2 shows cocoon yield (57.80 kg/ 100 dfls) in Tripura only.
- HRD Programme: 10 staff of DOS, Jorhat & Golaghat were trained under Trainers Training Programm, 2341 farmers were sensitized through organizing Farmers Training Programme and trained in latest technologies.
- BV-CPP: A total of 3304 acres of HYV mulberry are being maintained in 8 different clusters in N.E. states. A total of 2733 farmers were sensitized through 67 nos. Extension Communication Programme. Moreover, 10.255 lakh dfls were reared in three seasons among the clusters and produced 45.55 kg cocoon per 100 dfls and 53.83 t raw silk during the period.
- ✤ HYV: A total of 47.00 acres land was expanding by 75 farmers with High Yielding mulberry varieties S-1635 and 64000 saplings have been raised with High Yielding mulberry varieties S-1635.



- Extension Communication Programme (ECPs): A total of 111 ECPs viz., Awareness, Field day, Audio Visual, Exhibition, Group discussion, Technology demonstration, Resham Krishi Mela cum Exhibition Programme organized and sensitized 11748 farmers.
- ✤ Popularization of Yellow sticky traps for whitefly management: The yellow sticky trap has been found effective in control of white fly as its shows leaf yield of 4.2/ha/crop against the control of 3.7 kg by recording a 15.77 % increase in leaf yield.
- Popularization of Thiamethoxam for whitefly management: The spraying of Thiamethoxam in mulberry garden in farmers level shows a better leaf yield (4.15 t/ha/crop) over the control plot (3.57 t/ha/crop) which reveals 16.25 ton.
- Publication: 3 -Technical reports, 27 Books & Leaflets, 7- Newspaper reports have been published by RSRS, Jorhat & its nested units and participated in 5 TV/ Radio talks.
- Other Programme: A seminar has been organized on 21st Feb., 2018 on the Topic, "Role of Chawki Rearing Centres in Silk Production" at RSRS, Jorhat.

2. INTRODUCTION

Central Sericultural Research Station at Berhampore established in 1943 has been certified as ISO 9001: 2015 Institute for rendering outstanding Research, Developmental, Technical, Technological, Extension and Service support to silk industry by developing package of practices for mulberry development, silkworm rearing, innovations, products, development of region specific breeds and processes suited to the Eastern and North Eastern regions comprising of 13 states, 5 in Eastern regions *i.e.*, West Bengal, Odisha, Bihar, Jharkhand, Chhattisgarh and 8 in North Eastern regions like Assam, Manipur, Meghalaya, Mizoram, Nagaland, Arunachal Pradesh, Sikkim and Tripura.

The Institute is having 31 acres of mulberry plantation out of 56.74 acres of land, of which, it envisages its R&D and extension activities through seven major divisions namely Moriculture; Sericulture; Biotechnology; Reeling & Spinning; Training; Project Monitoring, Coordination & Evaluation (PMCE) and Extension & Publicity comprising of seven research sections *viz.*, Mulberry Breeding & Genetics, Agronomy Soil Science, Mulberry Pathology, Entomology, Silkworm Breeding & Genetics, Silkworm Physiology & Rearing Technology Innovations and BV cell and Silkworm Pathology besides Computer and Administration.

For dissemination of the developed technologies to the farmers and to get a regular feed back through its nested units, the Institute has an extension network of three Regional Sericultural Research Stations (RSRSs), 13 Research Extension Centres (RECs) located in 5 Eastern and 8 North-Eastern states.

VISION:

"To become Eastern and North Eastern states, a region for Centre of excellence in Sericulture and keeping it sustainable"

MISSION:

- ✤ Continuous R&D efforts and effective Transfer of Technology.
- Popularizing of HYV of mulberry suitable for different agro-climatic region.
- Popularizing region & season specific bivoltine hybrids combating high humidity and temperature.
- ✤ Popularization of improve package of practices.
- ✤ To create greater opportunities for gainful employment.
MANDATES:

Main Research Institute

- Conduct scientific, technical and economic research to enhance production, productivity and quality of Indian silk.
- Development of package of practices for Host Plant, Silkworm rearing, Post Cocoon Technology and its dissemination.
- Commercialization of products & Technologies and industry interface.
- Efforts to reduce input cost & drudgery and by-product utilization to increase net income and productivity.
- Enhance production of international grade silk for import substitution and earning foreign exchange.
- Human Resource Development.
- Maintenance of Breeders Stock.
- Disease & Pest Monitoring and Forecasting and Forewarning.
- Dissemination of knowledge, R&D innovations and package of practices through ICT tools.
- Undertake collaborative Research Programmes/ Projects with reputed National and International R&D institutions.
- Strengthening institutional framework to support ongoing research allied activities scientific and technical services.
- Inter institutional collaboration for better synergy.
- Studies on techno-economic feasibility of sericulture technologies.
- Providing technical and consultancy services.

Nested Units: RSRSs

- Identify region specific problems, undertake research studies and feedback analysis in consultation with respective DOS and allied units.
- OST and on-farm trials (OFT) for test verifying the technologies developed by the main research institutes and suggest fine tuning / modifications of such technologies to provide solutions to region specific problems.

- Conduct OFT/ demonstration of the selected technologies with selected farmers in coordination with DOS.
- Popularize the proven technologies using various extension methods through cluster area approach.
- Conduct training for both grass root level extension staff of DOS and farmers on advanced technological aspects.
- Crop monitoring and troubleshooting / crisis management.
- Conduct survey on crop yield, economics and disease & pest surveillance for forecasting/ forewarning.
- * Coordination of Cluster Promotion Programme.
- Soil health analysis and database maintenance of sericulture farmers.

Nested Units: RECs

- Front line demonstrations of technologies through selected farmers in coordination with DoS.
- Popularize the proven technologies through various extension methods through cluster area approach.
- Resource centre for critical inputs and seri appliances such as mulberry cuttings, silkworm seed, chemicals etc.
- Conduct farmers' training on various technological aspects.
- Conduct survey on crop yield, economics and disease and pest surveillance for forecasting/ forewarning.
- Coordination with Department of Sericulture and allied department in all extension activities.
- Conservation of eco-races prevailing in the region.
- Collection of feedback on technologies / services, analysis and crop monitoring.

3a. ACHIEVEMENTS ON RESULTS FRAME WORK DOCUMENTS (RFD)

#	Objectives	Actions	Success Indicator	Target	Achievement	
1	Conduct scientific, technical and	Undertaking Research	Total on- going Projects (No.)	16	36	225%
	economic research	projects to	Projects Concluded (No.)	10	13	130%
	to enhance	enhance quality	New Projects taken up	10	12	120%
	production,	and	(No.)			
	productivity and quality of Indian	productivity.	New Projects taken up at RSRS's (No.)	5	4	80%
	silk. (Research Projects-Coded by CO)	Technologies / innovations developed /likely to be developed out of concluded projects. (No.)	1	4	400%	
			New Technologies for field testing (No.)	1	2	200%
		Mechanization of sericulture industry	Equipment/ machines newly developed for sericulture mechanization (No.)	1	1	100%
			Machines / equipment absorbed in the field (No.)	1	1	100%
2	Commercialization	Sericulture	Technologies	1	0	-
	of products and	including	commercialized (No.)		-	
	Technologies	chemical taken up for commercial- ization /patenting	Technologies applied for patenting (No.)	1	0	-
3	IT Initiatives	Development of data base and technology	No. of Farmers database created for m-Kisan Portal (No.)	1700	1349	79%
		under IT initiatives	No. of Messages up- loaded in m-Kisan Portal (No.)	70	123	176%
			Up-loading of data in " Seri-5k" Portal [Farmer (No.)]	2000	4534	226.7%
			No. of Research Projects uploaded for E- Monitoring (No.)	16	24	150%
			Digitization of Soil Health Records (Acres)	7200	5928	82.3%
			Preparation of Technology adoption document/ Video	4	6	150%

#	Objectives	Actions	Success Indicator	Target	Achiev	ement
		Implementati	% of implementation of Direct Benefit Transfer(DBT)	100%	100%	100%
			Submission of DBT Annexures 1&4	100%	100%	100%
4	Field level Interventions for	Interventions through main	Number of Seri-model Village, identified	13	14	108%
	Ouality and	Institutes	(No.)			
	productivity	level	No. of farmers adopted	1040	1210	116%
	Improvement		(No.)			
	through		Expected rawsilk	48.0	42.33	88%
	Information,		Output (MT)			
	Education and	Large scale	No. of dfls proposed	0.45	0.91	202%
	Communication	trial of L14 X	for large scale trial			
	and Capacity	S8 & other	(Lakh Nos.)			
	Building	ICB breeds				
		Interventions	Number of Blocks/	15	15	100%
		through	Districts adopted (No.)			
		RSRS/ REC	No of farmers covered	2700	5768	214%
		level	(No.)			
			Rawsilk Output (MT)	90	176.76	196%
		New planta-	Popularization of	72	91.35	127%
		tion with	C2028, C2038 and			
		improved	S1635 varieties (acres)			
		varieties				4000/
		Organization	No of villages covered	1	1	100%
		of Swachha	Adoption of villages (%)	90	90	100%
			Number of formers	2500	2660	105%
		Adoption of	covers under 100%	3500	3000	10576
		Technologies	adoption of technology			
		amongst	(No.)			
		different stake				
		holders	NL C	100	010	4400/
		Extension	No of programmes	180	213	118%
		n programmas	No of farmers covered	8200	15279	186%
		viz Group	(No.)	0200	15217	10070
		discussion	Post programme follow	90	98%	100%
		Awareness	up (%)			
		programme.	Participation in Radio	9	29	322%
		Field days.	Programm (No.)	=	ø	1600/
		Krishi Melas	Programm (No.)	3	ð	100%
		etc.				

#	Objectives	Actions	Success Indicator	Target	Achiev	ement
			No of success stories	5	3	60%
			submited for			
			publication under			
			various aspects			
			Number of papers /	9	12	133%
			popular articles			
			published like Indian			
			Silk Magazine			
			Video of International	2	2	100%
			quality on all the			
			popular technologies			
			developed by Institute			
		Skill	Beneficiaries trained	400	2390	598%
		Development	under structured			
		1	programmes, need			
			based programme etc.			
			(No.)			
5	Revenue	Generation of	Revenue generation	0.54	1.26	233%
	Generation	funds as per XII	through commercial-			
		Plan guidelines	isation of Technology			
			(Rs. In lakh)			
			Revenue generation	20	19.25	96%
			(Do In John)			
6	Strongthoning	Utilization of	(KS. III lakil) Effective utilization of	31	31	100%
U	institutional	existing land	cultivable land for	51	51	10070
	framework to	holdings	assigned mandates			
	support ongoing		(Acres)			
	research and	Utilization of	Expenditure under	30.61	37.41	122%
	related	Grants	Central Sector Schemes.			
	programmes		(Rs. In Crore)			
7	Collaborative	Identifying	Projects taken up for	1	1	100%
	Research	potential R&D	collaborative research			
	Programmes	institutes in India	(No.)			
	with other R&D	and abroad and				
	organizations in	collaborativa				
	abroad	research prog_for				
	avivau	the benefit of both				
		the countries				
8	Administrative	Swachha Bharat	% of implementation	90	98	100%
	Reform	Abhiyan	, s si implementation	20	20	10070
		Biometric	Units functioning	17	17	100%
		Attendance	under the Institute	1/	1/	10070
		1 Interiouniee	(No.)			

Overall RFD Score = 96%



3b. ORGANIZATIONAL CHART





4. HIGHLIGHTS OF OUTPUT FROM THE CONCLUDED PROJECTS/ PROGRAMME

PROJECTS (11 Nos.), PILOT STUDY (1 No,) & PROGRAMME (1 No.)

- AIB 3514: Five breeds viz., 1. M.Con.4^{Id} (Pseudo pigmented Diapause Inhibitor Yellow Oval shaped cocoon), 2. M.Con.4^{Id} (Non pseudo Diapause Inhibitor Yellow Oval shaped cocoon), 3. M.Con.4^{Id} (Pseudo Pigmented Butter Colour Cocoon), 4. B.Con.4^{Id} (Pseudo Pigmented Butter Colour Cocoon) and 5. BHB^{Id} (Pseudo Pigmented White Colour Oval & Dumbbell) with *Id* character has been developed. Two breeds has been utilized for making bi x multi dfls with hatching of more than 90% has been observed without acid treatment like multi x bi dfls.
- AIB 3547: The sericulture farmers are facing unfavorable conditions of environment in tropical areas which affects the silk production. Rearing of thermo-tolerant breeds will be one of the most effective methods to increase silk productivity. Two hybrids *viz.*, HTH-3 x HTH-6 and HTH-4 x HTH-9 have been identified as tolerant to high temperature (35° C) and high humidity (>90%).
- 3. AIB 3545: One new Bi x Bi hybrid- B.Con.1 x B.Con.4 and one new Multi x Bi hybrid- M6DPC x (SK6 x SK7) were tested during 2014 to 2017 in West Bengal, Jharkhand, Odisha and North-East states. Based on the overall performance at farmers' field, during favourable seasons (Agrahayani, Falguni and Baishaki) it is recommended to rear the multivoltine hybrids, M6DPC x (SK6 x SK7) in West Bengal and Jharkhand states. With regard to bivoltine hybrids, it was recommended to rear B.Con.1 x B.Con.4 in West Bengal, Jharkhand North Eastern states.
- 4. **AIT3557:** Non-significant difference was observed upto 5th cycle of comparative rearing of Transgenic [N (T) x (SK6 x SK7)] and Non-Transgenic hybrid [N x (SK6 x SK7)].
- 5. PPE 3517: Population of thrips observed more than ETL when max. temp. was about 38°C. Increased RH and rainfall, observed the less population of thrips. When the min. RH increased (>50%), the *white fly* population was significantly high. Adult whitefly population decreased due to heavy rainfall. The highest incidence of mealy bug was observed during June when maximum temp. was >38°C and min. temp. was around 23°C. Heavy rainfall

decreased mealy bug population as it washes away the eggs, adults and other stages of mealy bug. Naturally available parasitoids like *Encarsia* spp. are capable to control the mealy bug by consuming the nutrient from host body which led to mortality of the mealy bug nymphs. The abiotic factors like max. temp. of 29° C (Aug.) and 30° C (Sept.), max. humidity of 99% (Aug.) and 97% (Sept.) helped in population buildup of root mealy bug in Kalimpong.

- 6. **PPE 3533:** The highest incidence of whitefly was observed in the mulberry germplasm accessions during Aug. in most of the varieties due to favorable temp. [Max.-35°C and Min.-27°C] and humidity [Max.-81% and Min-77%]. Lowest incidence was observed during Nov. which is attributed to lowest temp. - both Max. (24.4°C) and Min. (14.6°C). Stomata frequency/mm² of fresh leaves was less in the mulberry germplasm accessions with low infestation by whitefly whereas the number of stomata were higher in mulberry germplasm accessions with high infestation by whiteflies. Acyl Sugar (Δ A mg-1 fresh leaf) was higher in mulberry germplasm accessions with low infestation by whiteflies while it was less in mulberry germplasm accessions with high infestation by whiteflies. From statistical analysis it is observed that t-value of the Acyl sugar is higher than the t-value of stomata frequency. Based on this statistic it can be inferred that Acyl sugar content in the mulberry germplasm accessions may be a marker for selection of whitefly resistant variety apart from number of stomata/mm² of fresh leaves of mulberry.
- 7. PIB-3521: Evaluated eight powdery mildew resistant promising mulberry progenies under FYT. One of the PM resistant genotype (PMY-5) exhibited ~29% more leaf yield potential over ruling cultivar S-1635. The genotype was approved by MVAC for AICEM-IV trial. Tested ~30 PM specific putative markers on three generations of segregating progeny with phenotyping. Two allelic bands of 182 (MM68) and 190bps (MM128) showed very strong correlation with phenotypic disease reaction. Significantly higher correlation in F2 (>80%) than F1 indicated refinement of the trait over generations and suggest the possibility of association of trait and marker(s).

- 8. **PIB 3481:** Genotype C-9 recorded highest annual leaf yield (49.89 & 34.01 t/ha/y), which is 13% & 27% higher over S-1635 under full and half NPK dose, respectively. Under rainfed condition, the C-9 was found to be superior with average leaf yield 14.02 t/ha/yr., which is significantly 28% higher over S-1635. So far as the bioassay parameters are concerned, the study revealed that the performance of C-9 was found at par with that of the Check, S-1635.
- 9. **PIN 3587**: Economic analysis revealed that application of *A. nodosum* extract @ 0.5 ml /L at 21 and 28 DAP was most suitable for increasing leaf yield in mulberry with a cost benefit ratio of 1:1.67.
- 10. PPS 3559: Standardized farming protocol in terms of maximizing carbon sequestration in mulberry cultivation will be popularized among the sericulture farmers to meet of the current global needs. Moderate tillage with grass covers registered carbon capturing of ~ 9% improvements (632 kg/ ha/ crop) as compared to intensive tillage without grass cover (576 kg /ha/crop).
- PPA 3499: Popularization of the variety will be useful in enhancing leaf production. Vishala mulberry variety (irrigated) at 23 locations of WB exhibited ~ 9 % more leaf yield than S-1635 (35.72 t/ha).
- 12. **BPI (PS) 010:** Thermo-tolerance abilities of 11 bivoltine breeds were tested on the basis of survival, pupation and Reactive oxygen species (ROS) stabilisation abilities under the regime of 35° C with 80% RH against the control of 25° C. Three breeds (B.Con.4 > B.Con.1 > BHR-3) showed thermo-tolerance on the basis of survival and superoxide dismutase (SOD) activity. Highly-significant breed variation and correlation of SOD activity with survival showed the potential of the enzyme to use as selective markers to elucidate temperature stress associated feature(s) in silkworm *Bombyx mori*.
- 13. **B-JRH (P) 040:** The analysed data shows that, leaf yield (12.272 t/ha/yr) and cocoon yields (61.24 kg) data was higher in **MI-0349** (Garbandha-2) among the 23 accessions and this accession may be recommend for further multiplication.

5. AWARDS AND RECOGNITIONS

✓ **ISO 9001-2015 Standards:** Continued through surveillance audit at CSR&TI, Berhampore for the year 2017-18.



- ✓ Green Reap Welfare Society (GRWS) conferred "Young Scientist Award" to Shri Suresh, K. Sci-B for outstanding contribution in the field of *Genetics and Plant Breeding* on the occasion of National Conference on "Technological Challenges in Social, Environmental and Agricultural Reforms (TECHSEAR-2017)" held during 9th & 10th Sept., 2017 at ICAR-IIRR, Hyderabad.
- ✓ Dr. Anil Pappachan, Sci-B of this Institute has been awarded with Ph.D. degree in Plant Pathology from the University of Agril. Sciences, Bangalore dated 9th Feb., 2018.
- ✓ Dr. N. Chandrakanth, Sci-B of this Institute has been awarded with Ph.D. degree in Biotechnology from the University of Mysore, Mysuru, Karnataka dated 12th March, 2018.

6. TECHNOLOGIES TRANSFERRED DURING THE YEAR

TECHNOLOGY PACKAGES WERE EXTENDED FOR MULBERRY CULTIVATION AND SILKWORM REARING THROUGH SERI MODEL VILLAGE:

The fundamental objective is to develop a model village that will be a class apart in itself, with 100 % adoption of technologies extended - in a package module by CSR&TI Berhampore.

Progress: Overall Performance of SMV for 2017-18

- The Seri Model Village was conducted with 1210 farmers (*Irrigated*: 700 Nos.; *Rainfed*: 510 Nos.) covering the eastern and north-eastern region of India.
- > Separate packages for irrigated and rainfed conditions were designated.

Irrigated conditions

- The leaf yield recorded with the Seri Model Village farmers was 41.43 mt/ha/yr. against 37.23 mt/ha/yr with the non-SMV farmers, registering a gain of 11.3 %.
- A total of 1.4 lakhs dfls of M x B were reared under irrigated conditions during the year.
- The cocoon yield recorded was 48.7 kg/100 dfls against 44.2 kg, reflecting a gain of 10.6 %.

Rainfed conditions

- A total of 10000 M x B dfls were reared by 50 farmers at Dhenkikote and the results recorded were 38.2 kg against 33.8 kg/100 dfls. Gain: 13.0 %. The leaf yield recorded was 17.4 mt/ha/yr. against14.5 mt with non-SMV farmers (Gain: 9.3 %).
- A total of 72750 B x B dfls were reared by 460 farmers and the leaf yield recorded was 12.42 mt/ha/yr. against 11.1 mt. at non-SMV level (Enhancement: 11.9 %).
- The cocoon yield under SMV recorded was 49.2 kg/100 dfls and the yield range observed was 40.4-57.8 kg/100 dfls.

Rainfed (M x B):

SI. No.	Name of the Centre	Name of the Village	No. of farmers	Leaf Yield (mt/ha/crop)		DFLs/ Comb.	Yield/1 (kg)	00 dfls (kg)
				Т	С		Т	С
1	REC Dhenkikota	Saraskola	50	5.8 (9.3%) 17.4*	4.85 14.55*	10000 Nx (SK6xSK7)	38.2 (13%)	33.8

NB : Under rainfed conditions, 3 crops per year with MxB. *Leaf Yield in mt/ha/yr

Sl no	Name of the Centre	Name of the Village	No. of farmers	Leaf (mt/ha	Leaf YieldDFLs/(mt/ha/crop)Comb.		Yd/100] (kg)	DFLs)
				Т	С		Т	С
1.	RSRS, Kalimpong	Mahakaldhara	25	4.2 (16.7 %)	3.6	1250 SK6xSK7	40.4 (13.5%)	35.6
2.	RSRS, Jorhat	Chapori	50	4.1 (13.9 %)	3.6	2500/2500 B.Con.1xB.Con.4 SK6 x SK7	42.8 43.5	-
3.	REC, Imphal	Yumnamkhunou	70	4.19 (12.1 %)	3.7	7000/7000 B.Con.1xB.Con. SK6xSK7	47.5 45.2	-
4.	REC, Aizawl	Saitual	60	4.2 (13.5 %)	3.7	6000/6000 B.Con.1xB.Con. SK6xSK7	51.5 49.2	-
5.	REC, Shillong	Ummulong Wahiajer	50 50	3.8 (10.8 %)	3.43	2500/2500 FC1xFC2 2500/5000 BCon1xBCon4 SK6xSK7	50.3/57.8 57.64 46.85	-
6.	REC, Agartala	Chikancharra	30	4.0 (8.7 %)	3.68	1500/1500 B.Con.1xB.Con. FC1xFC2	50.6 54.0	-
7.	REC, Mongaldoi	Halda Rowmari	60 65	4.5 (8 %)	4.17	12500/12500 B.Con.1 x B.Con.4 SK6 x SK7	55.0 46.2	-
		Total=	460	4.14 (12.42)*	3.7 (11.1)*	72750	49.2	

Rainfed (B x B):

Irrigated:

#	Name of the Centre	Name of the Village	No. of farmers	Leaf Y (mt/ha/	Leaf Yield DFLs/ (mt/ha/crop) Comb.		Yield/100 dfls (kg)	
				Т	С		Т	С
1	CSR&TI, Berhampore	Balashpur	200	8.46 (11.9%)	7.56	40000 Nx(SK6xSK7)	38.55 (7.1%)	36.0
	Nadia	Barbakpur	50	8.5 (8.3%)	7.85	10000 Nx(SK6xSK7)	52.0 (10.6%)	47.0
2	REC, Mothabari	Bangalgram	200	8.42 (7.1 %)	7.86	40000 Nx(SK6xSK7)	44.6 (13.7%)	39.25
3	REC, Kamnagar	Sahebnagar	200	8.35 (10.4%)	7.56	40000 Nx(SK6xSK7)	55.1 (9.3%)	50.4
4	REC M.P. Raj	nritpur	50	7.7 (12.5%)	6.4	10000 Nx(SK6xSK7)	53.2 (10.1%)	48.3
		Total=	700	41.43*	37.23*	140000	48.7	44.2

*Leaf Yield in mt/ha/yr

NB : Under rainfed conditions, 3 crops per year with BxB. *Leaf Yield in mt/ha/yr

Popularization of technologies:

Four technologies were popularized through demonstration in 670 farmers' field.

> Popularization of Thiamethoxam for white fly management

Application of *Thiamethoxam* (0.015%) for whitefly management covered 150 farmers' field, the results reflecting saving of leaf loss by 7.9 - 12.3 %.

Popularization of Yellow Sticky Traps for the management of major mulberry pests

Yellow sticky traps for the management of major mulberry pests covered 250 farmers' field which resulted in yield of 7.15 kg against 6.56 t/ha/crop without the trap.

> Technology for application of sulphur fertilizer in mulberry field

Application of soil test based Sulphur fertilizer in mulberry field for productivity and quality improvement, covered 150 farmers and observed yield gain range of 6.8-10.4 %.

> Technology of foliar application of potassium chloride (KCl) in mulberry field under rainfed condition

Foliar application of *1% Potassium Chloride (Jalsanjeevini)* in mulberry field under rainfed condition for moisture retention covered 120 farmers and observed yield gain of 4.7-5.6 %.

Two seperate improved package of practices for **Rainfed and Irrigated** were dissminated:

Mulberry Cultivation	Silkworm Rearing
HYV - S1635 (Plains)	Use of general disinfectants and bed
BC259 (Hills)	disinfectants.
Spacing : 2' x 2' (Irrigated);	Productive silkworm hybrids :
3' x 3' (Rainfed)	Multi x Bi / Bi x Bi
FYM: 20 mt/ha/yr (Irrigated)	Incubation of dfls.
10 mt/ha/yr (Rainfed)	
Biofertilizers :	Chawki Rearing
Nitrofert: 20 kg/ha/yr (Rainfed: 10 kg/ha/yr) in 5	
equal split doze.	
Phosphofert: 75 kg/ha/yr (Rainfed: 40 kg/ha/yr)	
once in 4 years.	
Reduced doze of chemical fertilizers:	Late age rearing
N:P:K =168:30:112 kg/ha/yr	
(Rainfed : 75:10:50 kg/ha/yr)	
(15 days after application of Biofertilizer)	
Irrigation: As and when required.	Timely mounting and harvesting
Pruning, inter cultivation & weeding : As per	Integrated disease & pest management
crop schedule	
Integrated pest & disease management	



EXTENSION COMMUNICATION PROGRAMMES (ECP)

With the objective of dissemination of farmer friendly technologies and fore-warning the farmers about any probable – upcoming field and rearing oriented problems and probable suggestions, a total of 244 programmes were conducted and 16748 persons were sensitized.

Sl. No.	Events	Target	No. of events (farmers)
1.	Resham Krishi Mela	17	17 (5124)
2.	Workshop	4	4 (293)
3.	Farmers' Day	38	35 (1585)
4.	Field Day	41	39 (1987)
5.	Exhibition	-	9 (1887)
6.	Awareness programme	41	41 (2576)
7.	Group discussion	61	61 (1894)
8.	Technology demonstration	41	38 (1402)
	Total	243	244 (16748)

HUMAN RESOURCE DEVELOPMENT (HRD)

Towards generation of human resource, HRD programmes (Trainers' Training prog. and Farmers' Training prog. were conducted). A total of 8 TTP and 135 FTP programmes were conducted extending training to 4668 Trainers and Farmers, respectively.

Sl. No.	Events	Target	No. of events (farmers)
1.	Trainers' Training prog.	6	8 (78)
2.	Farmers' Training prog.	135	135 (4590)
	Total	141	143(4668)

MESSAGES SENT THROUGH M-KISAN/ IFFCO KISAN PORTAL

During 2017-18, 1349 data base for the farmers were created. A total of 123 nos. of messages were sent from the institute in 6 languages (*Bengali, English, Hindi, Nepali, Oriya and Manipuri*) covering 4191 farmers.

Through *IFFCO kisan portal*, 102 nos. of messages were sent to 330 farmers in their mobiles in Bengali.

#	Language	No. of	No. of	Details of o	latabase created
		Messages sent	farmers covered	State	No. of database created
1	Bengali	43	2290	West Bengal	416
2	English	7	423	Assam	183
3	Hindi	23	743	Manipur	189
4	Nepali	15	323	Meghalaya	124
5	Oriya	13	119	Nagaland	273
6	Manipuri	22	293	Sikkim	164
	Total	123	4191		1349

RAISING OF SAPLINGS

Against a target of 180000, a total of 118460 saplings were generated.

#	Units	Target(Nos)	Achievement(Nos)
1.	RSRS Kalimpong	10000	6000
2.	RSRS Jorhat	10000	14000
3.	REC Kamnagar	40000	40900
4.	REC Bhandra	10000	7500
5.	REC Shillong	5000	5000
6.	REC Dimapur	50000	20000
7.	REC Imphal	5000	5060
8.	REC Mongoldoi	50000	20000
	Total	180000	118460

REVENUE GENERATION (Rs.)

Sl.	Units	Target	Achievement
No.			
1.	RSRS Kalimpong	15000	42160
2.	RSRS Koraput	10000	30468
3.	RSRS Jorhat	10000	42275
4.	REC Mothabari	10000	14358
5.	REC Kamnagar	10000	81800
6.	REC Bhandra	10000	8714
7.	REC Agartala	10000	42613
8.	REC Imphal	10000	20520
9.	REC Shillong	10000	16724
10.	REC Mongoldoi	10000	100200
	Total	105000	399832

Sl.	Units	Target	Achievement
No.		(Farmer/ Acreage)	(Farmer / Acreage)
1.	RSRS Kalimpong	5 (2.5)	*
2.	RSRS Koraput	10 (5.0)	12 (12.0)
3.	RSRS Jorhat	10 (5.0)	5 (10.0)
4.	REC Mothabari	20 (10.0)	26 (11.5)
5.	REC Kamnagar	20 (10.0)	17 (3.4)
6.	REC Mamring	5(2.5)	-
7.	REC M. P. Raj	5(2.5)	17 (2.5)
8.	REC Dhenkikote	10(5.0)	20 (10.0)
9.	REC Bhandra	20(10.0)	20 (10.0)
10.	REC Agartala	10 (5.0)	10 (5.0)
11.	REC Aijwal	10 (5.0)	17 (17.0)
12.	REC Shillong	10 (5.0)	10 (5.0)
13.	REC Dimapur	10 (5.0)	10 (5.0)
14.	REC Imphal	10 (5.0)	10 (5.0)
15.	REC Mongoldoi	10 (5.0)	10 (5.0)
16.	REC Balijan	5 (2.5)	5 (2.5)
	Total	170 (85.0)	189 (103.9)

EXPANSION OF MULBERRY ACREAGE

*Due to continuous "unrest and bandh" for 4 months in the Darjeeling hills, no expansion of mulberry acreage could be done.

#	Technology	Technology Details	Application	Stake	Expected
			Details	holder	Benefits
				(No.)	
1.	Popularization of	Spraying of	Application of	150	Leaf yield gain
	Thiamethoxam for white	Thiamethoxam on	Thiamethoxam		range of 7.9-
	fly management.	mulberry for	(0.015%) for		12.3%
		management of	whitefly		
		whitefly.	management.		
2.	Popularization of	Yellow polythene	Yellow sticky	250	Leaf yield gain
	Yellow Sticky Traps for	strips (2"x1') pasted	<i>traps</i> for the		is 9%
	the management of	with grease, @ 20 nos/	management of		
	major mulberry pests.	bigha.	major mulberry		
			pests.		
3.	Technology for	Application of soil test	Ammonium	150	Leaf vield gain
	application of sulphur	based Sulphur	sulphate		range of 6.8-
	fertilizer in mulberry	fertilizer in mulberry	application @ 40		10.4 %.
	field.	field for productivity	kg/ha/yr.		
		and quality			
		improvement.			
4.	Technology of foliar	Foliar application of	1 st foliar	120	Leaf yield gain
	application of potassium	1% Potassium	application-		is 4.7-5.6 %.
	chloride (KCl) in	Chloride	20days before		
	mulberry field under	(Jalsanjeevini) in	brushing		
	rainfed condition.	mulberry field under	followed by 2 nd		
		rainfed condition for	application after		
		moisture retention.	10days of 1 st		
			spray.		

7. TECHNOLOGIES/PRODUCTS /PROCESSES RELEASED

- Two Mulberry varieties viz., C-2038; a high yielding mulberry variety for irrigated and rainfed areas of E&NE India and Tr-23; a high yielding mulberry variety for acidic hills of Eastern India are authorized for cultivation.
- The farming practice, moderate tillage with grass cover, was found superior to existing farming practice (intensive tillage without grass cover) in terms of mulberry productivity and carbon capturing potential.
- Two weeds, "KURO" (in Nepali) (*Bidens pilosa*)and"MOTHEY" (in Nepali) (*Cyperus rotundus*)were identified as alternative host plants of root mealy bug.

8. PATENTS GRANTED: NIL

9. PATENTS APPLICATIONS FILED FOR PATENTING: NIL

10. LIST OF RESEARCH PROJECTS AND PROGRAMMES

Institute/	Ongoing			(Conclude	Total	
RSRS	Proj.	PS	Prog.	Proj.	PS	Prog.	
CSR&TI	21	-	7	11	1	-	40
RSRS	5	-	2	-	-	1	8
Total	26	-	9	11	1	1	48

10. A.Ongoing : 35 Nos. (26 Projects + 9 Prog.)

#	Code No.	Title	PI					
I.C	I. CLIMATE RESILENT SERICULTURE (6 Nos.)							
1.	PIB 3505	Development of drought tolerant mulberry variety for rainfed sericulture. (Jan., 2014 to Dec., 2019) [Collaborative project with CSGRC, Hosur]	Suresh, K. Scientist-B					
2.	PPS 3598	Arsenic contamination in mulberry sericulture of Bengal Plain and its alleviation through application of zinc in soil. (Nov., 2016 to Oct., 2019)	V.Vijay, Scientist-B					
3.	PPF 3585	Application of growing degree days as a model driver for developing mulberry yield weather model. (Oct., 2016 to Dec., 2018)	R. Mahesh, Scientist -B (fr01.01.18) M. Choudhuri, Scientist -D (up to 31.12.17)					
4.	AIB 3602	Development of thermo tolerant bivoltine breeds / hybrids of silkworm, <i>Bombyx mori</i> though marker assisted selection. (Nov., 2016 to Apr., 2021)	N. Chandra- kanth, Scientist -B					
5.	PPA 3560	Studies on high bush and tree type mulberry plantation under rainfed condition of Odisha. (Apr., 2014 to Mar., 2019)	S. K. Misro, Scientist i-C RSRS, KPT					
6.	AIB 3614	Evaluation and identification of suitable productive bivoltine hybrids for Odisha. (Oct., 2017 to Nov., 2019).	K.C.Brahma, Scientist -D, RSRS, KPT					
II. I	INPUT (COST REDUCTION (3 Nos.)						
7.	PPS 3600	Soil health card preparation for mulberry growing soils in Eastern and North-Eastern India. (Nov., 2016 to Oct., 2019).	D. Chakravarty, Scientist -D (fr 01.01.18) M. Chaudhuri, Scientist -D (upto 31.12.17)					

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#	Code No.	Title	PI
8.	PPA	Evaluation of low-cost drip fertigation systems on	R.Mahesh,
	3588	yield and quality of mulberry leaves. (Oct., 16 to	Scientist-B
		Mar., 19).	
9.	PPA	Studies on drum- kit drip irrigation with hydrogel	S.K.Misro,
	3613	on yield and water use efficiency of mulberry.	Scientist-C,
		(Dec., 2017 to Nov., 2019).	KSKS, KI I
III.	ECO FI	RIENDLY & ORGANIC FARMING (1	Nos.)
10.	PPA	Popularization of high bush mulberry plantation	M. Pamegham
	3622	techniques in Majuli, river island of the	Scientist -C,
		Brahmaputra, Assam. (Sept., 2017 to Aug., 2020).	къкъ, јн і
IV.	PRODU	UCTIVITY IMPROVEMENT (9 Nos.)	
11.	PIB	Evaluation of new mulberry genotypes for	Suresh, K.,
	3576	improvement in productivity and quality. (Jun.,	Scientist -B
		2016 to Jul., 2020)	
12.	PIC	Candidate gene based molecular marker(s) for	Suresh, K.,
	3554	screening promising recombinants in mulberry.	Scientist -B
		(Jan., 2016 to Dec., 2018)	
13.	PIB	Preliminary evaluation of newly evolved mulberry	Suresh, K,
	3610	genotypes for mulberry improvement. (June, 2017	Scientist -B
		to May, 2020).	
14.	ARP	Validation of the DNA makers in silkworm breed	G.C.Das,
	3605	developed by introgression of DNA markers	Scientist -D
		associated with NPV resistance using Marker	
		Assisted Selection breeding and large scale field	
		funded Collaborative Project with SBRI 1	
15		Tunded Conaborative Project with SDKL]	C C Data
15.	AIB 3577	Evaluation of multivoltine germplasm to identify	Scientist –D
	5577	suitable for Southern and Eastern India (Apr 16	& Z. Hossain
		to Mar., 219) [Collab. with CSGRC, Hosur]	Scientist -D
16.	AIB	Evaluation of exotic bivoltine silkworm breeds to	G.C.Das,
	3578	identify promising parental genetic resources.	Scientist-D &
		(Jun., 2016 to Sept., 2019) [Collab. with CSGRC,	A.K. Verma,
		Hosur]	Scientist -D

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#	Code	Title	PI				
	No.						
17.	AIB	Development of silkworm (Bombyx mori L.)	A.K.Verma,				
	3619	congenic breeds from a gene pool with higher	Scientist -D				
		genetic plasticity. (Phase-II). (Jul., 2017 to Jun.,					
		2020).					
18.	AIB	On farm trial of the breeds/ hybrids developed in the	A.K.Verma,				
	3616	project AIB 3501. (Sept., 2017 to Dec., 2019)	Scientist -D				
19.	AIB	Identification of region specific bivoltine hybrids	V.Lkashm-				
	3617	suitable for highly fluctuating and seasonally	anan,				
		variable climatic conditions of Eastern and North-	Scientist -D				
		Eastern India.(Phase-II) (Apr., 2017 to Mar., 2020).					
V.	DISEAS	SE AND PEST MANAGEMENT (4 Nos.)					
20.	PIB	Evaluation of bacterial leaf spot resistant improved	S.Chatto-				
	3548	progenies of mulberry for field utilization. (Jan.,	padhyay,				
		2016 to Dec., 2018)	Scientist -D				
21.	PRE	Assessment of designed antimicrobial peptides for	S.Chatto-				
	3589	mulberry protection against brown leaf spot and root	padhyay,				
		rot: a biotechnological approach. (Oct., 2016 to	Scientist -D				
		Sept., 2019)					
22.	ARP	Isolation, cloning and characterization of antibacterial	K.Rahul,				
	3522	protein(s) from <i>Bombyx mori</i> L. (May, 2015 to Jun.,	Scientist -B				
		2018) (A collaborative project with SBRL, Kodathi,					
22		Bangalore)	V Dahul				
23.	AKP 2500	studies on the efficacy of phototrophic bacterial	K.Kallul, Scientist -B				
	3390	diseases in silkworm Rombyr mori I (Oct 2016 to	Sciencist D				
		Sent., 2019)					
VI. BRIDGING GAP IN TECHNOLOGY ADOPTION (3 Nos)							
24.	MTS	Study on mulberry sericulture production in West	Manjunath				
	3599	Bengal: a statistical approach. (Nov., 2016 to Apr.,	a, G.R.,				
		2018)	Scientist -B				
25.	МОТ	Skill gap analysis and capacity development of	Manjunatha,				
	3601	sericulture extension workers and farmers in	G.R., Sci-B				
		traditional and non-traditional states. (Nov., 2016 to	(fr. Feb., 18)				
		Apr., 2018)	Sci-B (Unto				
			Jan.,18)				

#	Code No.	Title	PI							
26.	MOE 3604	Yield gap analysis in mulberry leaf and cocoon production - A study in Eastern ghat highland zones of Odisha. (Dec., 2016 to Nov., 2018)	K.C Brahma, Scientist -C, RSRS, KPT							
VII.	VII. ROUTINE PROGRAMME (9 Nos.)									
27.	BPI(P) 025	Maintenance of mulberry germplasm bank at CSR&TI, Berhampore (W.B). (Jan., 2013 to Dec., 2018)	D. Chakravarty, Scientist -D							
28.	BAI (RP) 003	Maintenance of Multivoltine and Bivoltine Germplasm. (Continuous Nature)	V. Lakhsmanan, ScientistD & A. K. Verma, ScientistD							
29.	BAI (RP) 021	Silkworm disease monitoring of seed and commercial crop rearing of West Bengal (SDMSCC) [A collab. Prog. ZSSO, Malda & DoT (Seri), W.B.] (Apr., 2016 to Mar., 2019)	Z. Hossain, Scientist -D							
30.	BPR (RP) 022	Survey and surveillance of mulberry pest in Eastern and North-Eastern region of India. (Jun., 2016 to May, 2021)	S. Chanda, Scientist -D							
31.	B-MOE (P) 43	Seri Model Village. (Sept., 2017 to Aug., 2020)	D. Das, ScientistD							
32.	B-MOE (P) 044	Adarsh Swachh Resham Gram Programme at Mallickpur-Diara Village. (Apr., 2017 to Mar., 2019)	N. Chandrakanth Scientist-B (w.e.f. 01.02.18), Shafi Afroz Scientist-B (up to 31.01.18)							
33.	B-PRP (P) 045	Forewarning of mulberry diseases of Eastern and North Eastern India. (Jan., 2018 to Dec., 2020).	A.Pappachan, Scientist-B							
34.	B-KPG (RP) 017	Maintenance of Bivoltine silkworm Germ Plasm. (Apr., 2015 to Mar., 2020)	R. Kar, Scientist -D, RSRS, Kalimpong							
35.	B-PRP (P) 046	Studies on mulberry germplasm in agro-climatic condition in North East State, Assam. (Sept., 2017 to Aug., 2020).	M. Pamegam , Scientist-C, RSRS, Jorhat							

10. A.ONGOING RESEARCH PROJECTS & PROGRAMMES 10.A.I. CLIMATE RESILENT SERICULTURE

10.A.I.1. MULBERRY BREEDING AND GENETICS SECTION

10.A.I.1.1 PIB 3505: Development of drought tolerant mulberry variety for rainfed sericulture. (Jan., 2014 to Dec., 2019). [Collaborative project with CSGRC, Hosur]

Suresh, K. (**PI**), P.K. Ghosh (upto-30.06.2017), D. Chakravarty (fr.-01.07.2017), Anil Pappachan (CSR&TI, Berhampore) and K Jhansi Lakshmi and A. Sahay (fr. 01.04.2016) (CSGRC, Hosur).

Objective: Development of drought tolerant mulberry variety.

Progress: Preliminary evaluation of progenies of ten crosses for physiological traits, leaf yield and its component traits:

Evaluated two hundred and two shortlisted seedlings under PRT for various morphophysiological traits and leaf yield during April, July and Sept., 2017 crop. The shortlisted seedlings showed wide variability for all the characters studied. Based on pooled data of five crops, identified thirty (30) mulberry genotypes with significantly higher annual leaf yield (>1.963kg/plant) over C-2038 (1.88 kg/yr.) under the prevailing rainfall along with better physiological traits *viz.*, specific leaf area (<250 g cm⁻²), chlorophyll content (>15 μ gcm²), leaf size (>150 cm²) and moisture content (>75 %) (Table1).

#	Parentage	Leaf	Leaf	TCC	SLA	MC	PH	NS	ID
		wt.(g)	area	(µgcm ⁻	(cm ² g- ¹)	(%)	(cm)	(No)	(mm)
-			(cm²)	<u></u>)					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	Baragarh-2 x Madhopur-4	3.508	183.5	17.2	311.1*	83.18*	184*	17*	3.50
2	Baragarh-2 x Madhopur-4	4.352	207.1	20.3*	250.4	81.00*	179*	07	3.80
3	Baragarh-2 x UP-23	4.768	269.2	11.8	285.2*	80.20*	210*	12*	4.00
4	Jalalgarah -3 x S-13	3.360	184.1	21.2*	221.1	75.21	175*	09	4.10
5	Baragarh-2 x Madhopur-4	7.244*	340.2	20.9*	172.0	73.44	215*	12*	3.50
6	ERRC -32 X Lazuraso	4.184	193.5	19.3	224.8	79.42	168*	10*	4.50
7	Baragarh-2 x UP-23	4.081	202.6	19.1	220.1	77.43	154*	13*	4.00
8	Baragarh-2 x Thailand	2.981	162.9	19.7	221.4	75.31	192*	16*	4.00
9	Baragarh-2 x Thailand	4.787	213.6	22.5*	178.9	75.06	143	13*	3.00
10	Saranth -2 x S-13	3.329	181.4	13.3	280.0*	80.53*	164*	10*	2.70
11	Baragarh-2 x UP-23	4.606	259.7	28.1*	229.3	75.40	150	09	4.00
12	Jalalgarah -3 x S-13	3.769	197.6	22.8*	225.8	76.78	177*	15*	2.70
13	Baragarh-2 x Thailand	4.502	207.3	14.1	204.7	77.50	163*	15*	3.00

 Table
 1. Mean values of Morpho-physiological traits among selected seedlings under PRT

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
14	Baragarh-2 x Madhopur-4	2.249	134.2	16.8	308.0*	80.61*	145	07	2.10
15	Khakad-2 x V-1	5.226	265.7	17.4	215.0	76.35	174*	14*	4.30
16	Jalalgarah -3 x S-13	3.852	179.13	15.1	203.6	77.15	186*	09	4.20
17	Jalalgarah -3 x S-13	3.448	174.62	16.9	203.3	75.09	158*	14*	3.00
18	Saranth -2 x S-13	3.547	137.2	16.4	153.5	74.80	167*	10*	3.50
19	Saranth -2 x S-13	2.950	160.17	13.3	230.1	76.41	211*	08	3.70
20	Baragarh-2 x UP-23	4.736	239.11	17.6	185.8	72.83	197*	14*	4.50
21	Baragarh-2 x UP-23	3.672	182.72	18.1	202.6	75.44	179*	09	5.50
22	Saranth -2 x S-13	3.901	195.42	15.4	259.9	80.72*	169*	09	4.00
23	Saranth -2 x S-13	5.967	239.7	24.7*	211.2	80.98*	179*	09	4.50
24	Saranth -2 x S-13	4.177	220.67	17.7	256.9	79.44	154*	08	4.70
25	Hosur C8 x Thailand	2.424	138.28	13.5	261.9	78.22	166*	08	5.10
26	Chirayinkizh x S-1	3.925	190.69	17.8	248.3	80.43*	142	11*	2.80
27	Hosur C8 x Thailand	5.404	275.55	14.6	231.4	77.96	165*	09	4.50
28	Chirayinkizh x S-1	3.091	157.87	17.3	223.3	77.13	200*	10*	3.50
29	Baragarh-2 x UP-23	4.769	226.64	14.3	213.0	77.69	140	08	3.30
30	Khakad-2 x V-1	5.804	289.91	21.8*	199.9	75.02	145	05	4.50
	Check C-2038	6.467	319.8	18.8	251.7	76.30	148	8.00	4.80
	CD @ 5%	0.524	45.68	1.20	15.24	2.86	6.86	1.10	0.68

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TCC (total chlorophyll content), SLA (specific leaf area), MC (moisture content), NPS (No of shoots per plant), PH (Plant height) and ID (inter nodal length.)

Multiplied and established thirty shortlisted seedlings under primary yield trial (PYT) for assessing the drought tolerance among the test genotypes under control and moisture stress condition.

10.A.I.2. AGRONOMY AND SOIL SCIENCE SECTION

10.A.I.2.1. PPS 3598: Arsenic contamination in mulberry sericulture of Bengal Plain and its alleviation through application of zinc in soil. (Nov., 2016 to Oct., 2019).

V. Vijay (PI), R. Kar, R. Mahesh and G.C. Das.

Objectives:

- To investigate the extent of arsenic load/accumulation in irrigation watersoil-mulberry plant-silkworm larva continuum under mulberry vegetation.
- To formulate dose of zinc for alleviating arsenic pollution in mulberry sericulture by application of zinc in soil wherein it is deficient.
- To validate the efficacy of laboratory findings by conducting the appropriate field trials.

Progress: Bio-accumulation of arsenic was found in healthy silkworms fed on arsenic bio-accumulated mulberry leaves grown on arsenic contaminated soil. The order of arsenic buid-up was: Soil > Mulberry leaf > Silkworm.

10.A.I.2.2. PPF 3585: Application of Growing Degree Days as a model driver for developing mulberry yield weather model. (**Oct., 2016 to Dec., 2018**).

M. Choudhuri (**PI**- up to 31.12.2017), R. Mahesh (**PI**- fr.-01.01.2018), Anil Pappachan and Manjunatha, G.R.

Objectives: To prepare a model driven by growing degree days towards forecasting growth and yield of instar specific mulberry leaves under the spell of daily accumulated heat and basic weather variables.

Progress:

- Five biofixation has been completed.
- Maintained the experimental field by adopting timely agronomic package practices
- Collected temporal mulberry growth and yield data *viz*, shoot length, shoot weight, leaf weight, dry shoot weight and dry leaf weight, etc., at 10 days interval from 30th days after pruning.
- Temporal data of five bio-fixations are compiled and data are presented in Table 2.

DAP (30 th days after pruning)	GDD (Growing Degree Days)	Leaf yield (g/plant)
30	412.52	201.37
40	550.04	269.14
50	706.94	330.94
60	864.49	306.46
70	1009.94	269.14
80	1153.94	201.37

Table 2. GDD against leaf yield on different growth stages of mulberry crop

10.A.I.3. SILKWORM BREEDING AND GENETICS SECTION

10.A.I.3.1. AIB3602: Development of thermo tolerant bivoltine breeds / hybrids of silkworm, *Bombyx mori* though marker assisted selection. (Nov., 2016 to Apr., 2021).

N. Chandrakanth (PI), V. Lakshmanan, A. K. Verma and N. B. Kar.

- **Objective:** To develop the thermo-tolerant bivoltine silkworm breeds / hybrids through DNA marker assisted selection and their evaluation.
- **Progress:** Based on the previous reports, two thermo-tolerant bivoltine silkworm breeds *viz*. SK4C and BHR3 and two productive bivoltine breeds *viz*. GEN-3 and D6 (M) were used as breeding resource material. DNAs of these silkworm breeds were extracted by using standard phenol chloroform method. The extracted DNAs were amplified using S0803 and S0816 microsatellite markers liked to thermo-tolerance in the silkworm.

SK4C and BHR3 showed thermo-tolerant banding pattern whereas GEN-3 and D6 (M) showed thermo-susceptible banding pattern with both the markers (Fig. 1).

Eight different combinations of hybrids were prepared by using these breeds as parents. Out of them, four combinations involving GEN-3 as parent were gone for F_2 population, where only plain larvae spinning oval shaped cocoons were selected.

#	BC ₁	Cocoon Shape	Designated
1	[SK4C x D6(M)] x D6(M)	Dumbbell	G1
2	[BHR3 x D6(M)] x D6(M)	Dumbbell	G2
3	[D6(M) x SK4C] x D6(M)	Dumbbell	G3
4	[D6(M) x BHR3] x D6(M)	Dumbbell	G4
5	(SK4C x GEN-3) x GEN-3	Oval	G5
6	(BHR3 x GEN-3) x GEN-3	Oval	G6
7	(GEN-3 x SK4C) x GEN-3	Oval	G7
8	(GEN-3 x BHR3) x GEN-3	Oval	G8

 Table 3. Details of the new Backcross combinations

Table	4.	Performance	of BC ₂	populations	at normal	temperature
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BC,	Cocoon	Fec. (No.)	Hatching	ERR	ERR (wt.)	SCW	SSW(g)	Shell
2	Shape		(%)	(No.)	(kg.)	wt.(g)	_	%
G1	Dumbbell	511	92	8400	11.875	1.332	0.246	18.47
G2	Dumbbell	508	94	8775	12.800	1.429	0.272	19.03
G3	Dumbbell	485	93	8400	12.450	1.384	0.265	19.15
G4	Dumbbell	492	96	9300	13.325	1.389	0.252	18.14
G5	Oval	498	95	7275	11.325	1.229	0.240	19.53
G6	Oval	504	91	8975	12.875	1.551	0.303	19.54
G7	Oval	491	92	9525	12.975	1.407	0.269	19.12
G8	Oval	521	96	9511	13.844	1.412	0.280	19.83
A	Average	500	94	8770	12.684	1.392	0.266	19.10
t	statistic	121.01**	137.7**	33.01**	45.00**	43.423	37.05**	95.55

** significant at p<0.01

```
Table 5. Performance of BC<sub>2</sub> populations at high temperature (36 \pm 1^{\circ}C)
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Breed	Cocoon Shape	Pupation rate (%)	ERR (wt.) (kg.)	SCW(g)	SSW (g)	Shell %
G1	Dumbbell	67	8.321	1.342	0.236	17.57
G2	Dumbbell	62	8.950	1.364	0.246	18.02
G3	Dumbbell	68	8.550	1.250	0.224	17.94
G4	Dumbbell	68	8.900	1.333	0.245	18.41
G5	Oval	64	7.650	1.226	0.233	19.00
G6	Oval	57	7.100	1.235	0.236	19.10
G7	Oval	75	8.100	1.196	0.229	19.88
G8	Oval	83	10.300	1.285	0.259	19.92
A	verage	68	7.984	1.254	0.244	19.50
ts	t statistic		24.95	41.58	48.66**	41.52 ^{**}
**significant at	t p<0.01					

Afterwards, all the combinations were backcrossed (BC) with their respective productive parents resulting in BC_1 . The BC_1 populations were renamed as G1 to G8 as shown in Table 3. In each generation, combination wise female mother moths were collected and their DNAs were amplified by markers S0803 and S0816. The dfls laid by female moths with heterozygous banding pattern for both the markers as shown in Fig. 2 were selected to rear in the next generation.



Fig. 1. PCR amplification of parent DNA using S0803 and S0816 microsatellite markers

Likewise, the BC₂ generation was prepared and reared at normal as well as high temperature $(36\pm1^{\circ}C)$ conditions. The performance of BC₂ populations at normal and high temperature conditions are presented in Table 4 and Table 5, respectively. Significant differences were found among the rearing performances of the BC₂ populations at normal as well as high temperature conditions. The breeding process will be continued by employing marker assisted selection



Fig. 2. PCR amplification of Female BC_1 moths used to prepare BC_2 populations

10.A.I.4. RSRS, KORAPUT

- 10. A.I.4.1.PPA3560: Studies on high bush and tree type mulberry plantation under rainfed condition of Odisha. (April, 2014 to March, 2019).
 - S.K.Misro (PI).
- **Objective:** To develop a package of practice for high bush and tree type mulberry plantation to avoid grazing problems in state of Odisha.
- **Observations:** After completion of the establishment period for 2 years the 3rd & 4th leaf yield data has been recorded during the months of Sept., 2017 and March, 2018 respectively are depicted in Table 6.

Table 6. Leaf yield data of high bush plantation

Spacing	L	eaf yield (kg /ha/ crop)
-	S-1635	C-1730
Season – Sept.	, 2017	
150 ×150	2819	2387
180× 180	2548	2240
240× 240	1803	1619
Season - March	n, 2018	
150 ×150	2459	2163
180× 180	1767	1587
240× 240	1436	1328

10.A.I.4.2. AIB 3614: Evaluation and identification of suitable productive bivoltine hybrids for Odisha. (**Oct., 2017 to Nov., 2019**).

K.C.Brahma (PI).

Objective: To identify bivoltine hybrids with better productivity traits suitable for Odisha region.

Progress: Two rearing was conducted and the performance of those are being mentioned here under

Oct. & Nov., 2017: The dfls of SK6 x SK7 and B. Con.1 x B.Con.4 from CSR&TI Berhampore, CSR50 x CSR51, CSR16 x CSR17, GEN3 x Gen2, CSR2 x CSR4, from CSR&TI, Mysore. Dun6 x Dun22 from RSRS Dehradun were received and reared during Oct.- Nov., 2017. The performance of the hybrids is CSR50 x CSR51 recorded the highest silk ratio of 21.42 followed by CSR16 x CSR17, GEN3 x Gen2, Dun6 x Dun22, CSR2 x CSR4, B. Con1 x B.Con4 and SK6 x SK7 with 19.71, 19.46, 19.44, 19.37, 17.81 and 15.58, respectively.

Feb. & March, 2018: Five (5) hybrids such as Dun6 x Dun22 from Dehradun; B. Con.1 x B.Con.4 and SK6 x SK7 from CSR&TI Berhampore; APS45 x APS12 and HTO5 x HTP5 from APSSRDI Hindupur were received for rearing during the Feb. & March, 2018 crop. The performance of Dun6 x Dun22 recorded as the highest silk ratio of 21.77 followed by HTO5 x HTP5, APS45 x APS12, B. Con.1 x B.Con.4 and SK-6 x SK-7 recorded with 19.9, 18.2, 16.66 and 15.45, respectively.

10.A.II. INPUT COST REDUCTION

10.A.II.1. AGRONOMY AND SOIL SCIENCE SECTION

10.A.II.1.1 PPS 3600: Soil health card preparation for mulberry growing soils in Eastern and North Eastern India. (Nov., 2016 to Oct., 2019).

K. Trivedy (**PI**), D. Chakravarty (from 01.01.18), M. Chaudhuri (upto 31.12.17), V. Vijay, R. Mahesh, A. Pappachan, K. Suresh (from 01.01.18), R. Kar, S.K. Mishra, S.N. Gogoi, R. Luikham, U.C. Boruah, M. Pamehgam, L. Somen Singh, S.T. Lepcha, Satyabrata Dey, G.S. Singh, B.K. Basumatary, C.Z. Renthlei, B.N. Choudhury, L. Pachuau, G.B. Singh, A. Borah, S. Chakraborty.

- **Objectives:** To analyze the soil parameters (pH, EC, OC, available N,P,K,S, Zn, Fe, Cu, Mn & B) of mulberry growing soils for preparation and distribution of SHC (18,000 nos.) to the seri-farmers in Eastern and N-E India.
- **Progress:** SHCs distributed to total 5640 farmers (CSR&TI-Berhampore, Main Unit = 5068; REC-Imphal = 472; RSRS-Jorhat = 100). List of the farmers are uploaded in CSR&TI, Berhampore website: *www.csrtiber.res.in*.
- **10.A.II.1.2. PPA 3588:** Evaluation of low cost drip fertigation systems on yield and quality of mulberry leaves. (**Oct., 2016 to Sept., 2019**).

R. Mahesh (PI), V. Vijay and Anil Pappachan.

Objectives:

- To evaluate the comparative performance of drip tape fertigation system and drum kit fertigation system under both $2^{+} \times 2^{+}$ and $3^{+} \times 3^{+}$ spacing on yield and quality of mulberry leaves.
- To optimize the fertigation schedule for higher mulberry leaf productivity.
- To evaluate the drip tape fertigation system and drum kit fertigation system on water use efficiency and fertilizer use efficiency of mulberry leaves.
- To compute the economics of drip tape fertigation and drum kit drip fertigation system in mulberry cultivation.

Progress:

- Assessed fertilizer solubility of conventional fertilizers urea (1070 g/L), DAP (550 g/L) and MOP (300 g/L) through jar test.
- Assessed quality of irrigation water like pH (6.8), EC (0.43 dS/m), SAR (0.71), Ca (104 ppm), Mg (38.2 ppm), K (4.6 ppm), Na (32.5 ppm), CO₃ (0 ppm), HCO₃ (427 ppm), Cl₂ (390.5 ppm) and TDS (272.5 ppm).

• Three experiments are completed and collected the crop growth, yield and quality data of mulberry crop. The result of first experiment is discussed hereunder below. Higher mulberry leaf yield of 527.9 g/plant (3'×3') and 254.4 g/plant (2'×2') were observed in fertigation of 100% RDF with drip tape fertigation system. Significantly higher leaf protein [62.72 (3'×3') and 44.78 (2'×2')] mg/g of green tissue was observed in 100% RDF with drumkit drip fertigation.

10.A.II.2. RSRS, KORAPUT

10.A.II.2.1. PPA 3613: Studies on drum kit drip irrigation with Hydrogel on yield and water use efficiency of mulberry. (Dec., 2017 to Nov., 2019).

S.K Misro (PI).

Objectives:

- To study the water use efficiency on different treatments of Hydrogels.
- To study the growth and yield performance of mulberry by application of Hydrogels.
- **Observations:** The cultural operations for the plantation are taken up. The plantation of the drum kit and procurement of Hydrogel is under progress.

10.A.III. ECO FRIENDLY & ORGANIC FARMING

10.A.III.1.RSRS, JORHAT

10.A.III.1.1.PPA 3622: Popularization of high bush mulberry plantation techniques in Majuli, river island of the Brahmaputra, Assam. (Sept., 2017 to Aug., 2020).

Mina Pamegham (PI).

Objectives:

- To assess growth characters, leaf yield of high bush mulberry plantations and cocoon productivity.
- Assessment of mulberry pest and diseases in different seasons.
- To popularize the high bush mulberry plantation technique in river island Majuli to enhance leaf yield and cocoon production per unit area and its socio- economic impact of sericulture farmers.
- **Progress:** Collected of farmers' profiles and primary data. Ten farmers selected and establish mulberry garden at their field. Cost of production will be reduced through mechanizations.

10.A.IV. PRODUCTIVITY IMPPROVEMENT

10.A.IV.1.MULBERRY BREEDING AND GENETICS SECTION

10.A.IV.1.1.PIB 3576: Evaluation of new mulberry genotypes for improvement in productivity and quality. (Jun., 2016 to Jul., 2020).

K. Suresh (**PI**), K.C. Brahma (RSRS, Koraput), S.N.Gogoi (RSRS, Jorhat), G. S. Singh (REC, Bhandra).

Objective: To evaluate high yielding mulberry genotypes with early sprouting behavior capable of producing sustainable leaf yield during winter months.

Progress:

• Generation of planting material and establishment of evolved test genotypes at 4 test centers:

Ten test genotypes along with check S-1635 were multiplied in two phases under nursery and a total of around 8,000 saplings generated were distributed and established at the four test centers viz., CSR&TI-Berhampore, RSRS-Koraput, RSRS-Jorhat and REC- Bhandra of Eastern and North-Eastern India.

 Table 7. Mean values of growth and leaf yield parameters of test genotypes during winter crop

#	Genotypes	Leaf	Days to	Total	Plant	Leaves	Leaf to	100	Leaf	Shoot
		yield	Sprout	snoot	neight	per ton	shoot	leaves	moisture	yield
		plot		length	(cm)	shoot	ratio (%)	weight(g)	(%)	plot" (kg)
						(NO)				
1	C-1	9.78	12.67	478.53	107.13	23.27	0.58	166.07	67.98	16.73
2	C-2	11.50	12.33	510.00	95.07	20.40	0.66	209.35	67.53	17.46
3	C-5	12.41*	15.00	533.27	122.00	19.15	0.64	247.01	68.33	18.41
4	C-9	7.06	15.67	414.27	106.40	18.52	0.63	244.25	69.57	11.27
5	C-11	14.83*	10.33	571.13	97.73	22.42	0.63	231.47	71.79	23.52
6	C-45	9.11	14.00	571.40	126.80	17.87	0.47	208.58	73.81	19.57
7	C-108	8.45	11.67	413.67	90.87	21.43	0.69	198.09	70.07	12.30
8	C-212	12.00	12.67	495.40	100.13	20.25	0.59	213.63	71.76	18.68
9	C-384	12.12*	14.33	579.73	123.53	17.27	0.56	327.82	71.91	21.79
10	S-1635	11.07	14.67	542.73	119.73	17.82	0.55	312.53	74.31	20.52
CD@	5%	1.01	1.76	38.59	8.65	1.24	0.02	18.43	2.22	1.74
CV		5.85	7.91	4.52	4.75	3.75	2.28	4.68	1.88	5.77

• Evaluation of test genotypes for leaf yield and its component traits (winter):

After five months of transplantation, the genotypes were given first pruning and data was recorded at 65-70 days after pruning. Assessment of leaf yield and its component traits indicated significant variability among the mulberry test genotypes.

The test genotype recorded wide variation for leaf yield per plot (7.06-14.83 kg/plot/crop), total shoot length (413.67- 579.73cm), plant height (95.07- 126.80cm), leaves per ton shoot (17.27 - 23.27 nos), leaf to shoot ratio (0.47- 0.69%), 100 leaves weight (166.07 - 327.82 g) and leaf moisture content (67.53 -74.31%) (Table 7). The genotype C-11 recorded significantly highest leaf yield of 14.83 kg per plot (49 plants) over check S-1635 (11.07 kg) followed by C-5 (12.41 kg) and C-384 (12.12 kg) during winter crop. These genotypes also showed higher mean values for total shoot length, leaf to shoot ratio and shoot yield per plant.

10.A.IV.1.2. PIC 3554: Candidate gene based molecular marker(s) for screening promising recombinants in mulberry. (Jan., 2016 to Dec., 2018).

Suresh, K. (**PI-**fr. 01.01.2017), R Banerjee (**PI-** upto -30.06.2017), S Chattopadhyay, Pooja Makwana and V Vijay.

Objective: To develop candidate gene based molecular markers of nitrate reductase and chalcone synthase in mulberry.

Progress:

• Evaluation of segregating population of crosses Kajli $OP \times V-1$ for Nitrate reductase activity, foliage yield and its component traits:

After ten months of transplantation of one hundred and fifty segregating progenies of the cross of Kajli $OP \times V$ -1, first pruning was given during Sept., 2017. The progenies were evaluated for various physiological traits, leaf yield and its component traits during Nov., 2017 and Feb., 2018 crop and are shown in Table 8.

	Crop	Leaf wt.	TCC	Leaf area	SLA	MC	PH	ID	NPS	LYP
		(g)	(µgcm ⁻²)	(cm ²)	(gcm ⁻²)	(%)	(cm)	(cm)	(No)	(g/plant)
Mean	Nov	3.31	12.71	178.71	241.43	76.95	104.15	3.53	6.70	322.64
	Feb	3.30	14.90	154.40	206.50	77.01	118.30	4.69	8.30	398.40
Range	Nov	1.19–	7.90-	77.95-	170.36-	57.84-	52.00-	2.00-	2.00-	72.00-
_		7.04	26.70	371.49	323.54	83.35	156.00	5.50	12.00	855.00
	Feb	1.28-	8.27-	74.8-	157.32-	69.61-	83.50-	2.89-	4.00-	127.00-
		7.04	30.37	314.7	403.56	82.01	164.50	6.58	27.00	776.50
Kajili C)P	3.60	15.10	151.60	183.50	77.30	110.80	4.85	11.10	578.20
V-1		4.07	12.28	162.91	174.26	76.35	115.40	4.36	7.70	284.82

Table 8. Estimation of mean and range of segregating F₁ population

TCC (total chlorophyll content), SLA (specific leaf area), MC (moisture content), NPS (No of Primary shoots per plant), PH (Plant height), ID (inter nodal length) and LYP (leaf yield per plant).

The range of variability was high for all the characters studied, indicated the high variability in the cross Kajli OP × V-1 (Table 8). The frequency distribution for leaf yield per plant during Nov., 2017 and Feb., 2018 crop was presented in (Fig.3a) and (Fig.3b), respectively. Skewness and Kurtosis indicated dominance based complementary gene interaction involving large number of genes having decreasing effect in the inheritance of leaf yield. Wide variation for powdery mildew incidence (0.00 to 72.12% PDI) during winter and nitrate reducates activity ($0.82 - 9.12 \Delta A_{543}$)

 $g^{-1}FW h^{-1}$) was observed among the progenies. Isolated the good quantity (172.9-9587.4 ng/µl.) and quality (~1.80 ratio) of DNA from 150 progenies and their parent



Fig. 3a & 3b: Frequency distribution of F₁ population of cross Kajli OP × V-1 for leaf yield plant ⁻¹ during Nov., 17 and Feb., 2018 crop

10.A.IV.1.3. PIB 3610 Preliminary evaluation of newly evolved mulberry genotypes for mulberry improvement. (Jun., 2017 to May, 2020).

Suresh K (PI), D. Chakravarty, D. Das and Anil Pappachan.

Objectives: Evaluation of improved lines for foliage biomass and associated agronomic traits under PYT.

Progress:

• Multiplication and Establishment of test genotypes in the experimental plot:

Twenty four test genotypes along with checks S-1635 & C-2038 were multiplied in two phases under nursery. Transplanted saplings of test genotypes along with two checks under Randomized block design with three replications in experimental plots at CSR&TI-Berhampore.

10.A.IV.2.SILKWORM PHYSIOLOGY & BV CELL

10.A.IV.2. ARP 3605: Validation of the DNA makers in silkworm breed developed by introgression of DNA markers associated with NPV resistance using Marker Assisted Selection breeding and large scale field trial of the breed. (Apr., 2017 to Mar., 2020). [DBT funded Collaborative Project with SBRL]

G.C. Das (PI) and N. Chandrakanth.

Objective:

- Validation of DNA markers for NPV resistance and stress tolerance in selection lines being used for field trial.
- Continuous maintenance of MAS-N Lines; Co-ordination and statistical analysis of observation from lines reared at different stations.

CSR&TI's objective:

- Evaluate the evolved bivoltine lines in various agro climatic conditions and selected lines for their suitability in that particular environment.
- Rearing of about 50000 dfls of Nistari x MASN lines will be prepared through NSSO, Bangalore and distributed to sericulture farmers in the area under CSR&TI, Berhampore (at farmers level).
- To evaluate bivoltine single hybrid (MASNxCSR4) using CSR2xCSR4 as control
- **Progress:** Three NPV resistance bivoltine breeds; MAS-N lines (4, 6 and 7) were tested in different seasons of this region to see the performance under the supervision of CSRTI, Berhampore at different climatic zones. Total 5 trials (Cellular rearing) of 3 Bivoltine MAS-N lines(4,6&7) with control CSR2 were conducted. Performance of the MASN line very good in respect of cocoon parameter especially in respect of survival% than its control. During unfavourable season the control CSR2 was not survived in this region (Table 9 to 11).
- Table 09. Performance study & Ranking of NPV resistant breeds during un-
favourable Seasons in W.B. (Apr.-Sept., 2017)

Breeds	Fec.	ERR No.	ERR wt.	SCW	SSW	SR%	Recovery %	Avg. MTI	Rank
MASN-7	525	3742	4.787	1.433	0.285	19.92	87	55.94	1
MASN-6	426	4490	5.408	1.347	0.270	20.02	86	47.68	2
MASN-4	475	2482	3.433	1.436	0.273	18.99	87	46.38	3

Avg. MTI- Average Multiple Trait Index

Table 10. Performance study & Ranking of NPV resistant breeds duringfavourableSeasons in W.B. (Nov., 2017 - Feb., 2018)

	Fec.	ERR No	ERR wt. kg)	SCW (g)	SSW (g)	SR%	Recovery %	Avg. MTI	Rank
MASN-4	552	6320	8.020	1.250	0.239	19.15	81.6	54.86	1
MASN-6	496	6060	7.521	1.235	0.242	19.59	81.0	49.58	2
MASN-7	626	5460	7.325	1.263	0.232	18.38	80.4	45.56	3
	A	TI America	Multinly To						

• Avg. MTI- Average Multiple Trait Index

Table 11. Reeling parameter of NPV resistant breeds during Nov. crop 2017favourable Seasons in W.B. (Nov., 2017 - Feb., 2018)

Breeds	FL (m)	Den.	Renditta	Raw silk	Rec%	Reelability	Neatness %	Evenness %
				%		-		
MASN-4	760	2.44	8.55	11.70	81.0	81.6	82.6	87.6
MASN-6	767	2.37	8.51	11.75	81.0	82.3	84.3	89.3
MASN-7	777	2.32	8.61	11.61	80.4	82.6	85.3	90.3



Photograph of Cocoons of different NPV resistant breeds

10.A.IV.3.SILKWORM BREEDING AND GENETICS SECTION

10.A.IV.3.1. AIB 3577: Evaluation of multivoltine germplasm to identify potential parents for developing cross breeds suitable for Southern and Eastern India. (Apr., 2017 to Mar., 2019). [Collaborative with CSGRC, Hosur & CSR&TI, Mysore & Pampore]

G.C.Das (Fr. Dec. 17), Z. Hossain [Upto Nov., 17] (**PI**) & N. Chandrakanth (fr. CSRTI, Berhampore) & N.Balachandran, M.Muthulakshmi, G.Thanavendan and S.Nivedita (from CSGRC, Hosur), K.K.Sharmila, Dayananda and Y.C. Radhalakshmi (from CSRTI, Mysuru).

Objectives: To evaluate multivoltine germplasm accessions for the identification of crossbreeds suitable for Southern and Eastern Zones.

Progress: Two rearing were conducted in this region to screen the hybrid performance during Nov., 2017 & Feb., 2018 crop. Based on the performance of 2 crops hybrids were ranked followed by Mano's evaluation index. Result in Table 12 indicated that combination made with multivoltine accession 79, 68 and 80 perform very well as ranked in top three. Similarly, Fig. 4 depicted the mortality due to disease incidence.



Fig. 4. Graphical presentation of mortality recorded during Nov. crop 2017 due to disease incidence

Hybrids	Fecundity	ERR No.	ERR wt. (ka)	SCW (g)	SSW (g)	Shell %	Recov- erv %	Avg. MTI	Rank
79 x 290	563	7730	11.720	1.507	0.301	19.99	79.0	59.48	1
68 x 290	424	7376	11.408	1.468	0.300	20.44	81.0	56.72	2
80 x 290	433	7946	11.979	1.483	0.301	20.32	74.0	55.24	3
82 x 290	432	7193	10.621	1.550	0.293	18.90	82.0	54.77	4
77 x 290	478	8113	12.276	1.481	0.269	18.16	83.5	54.31	5
55 x 290	401	7080	10.673	1.506	0.282	18.73	82.5	52.18	6
69 x 290	440	8513	12.430	1.523	0.261	17.14	82.5	52.10	7
25 x 290	417	6950	10.009	1.529	0.282	18.44	83.0	51.97	8
54 x 290	395	6796	9.567	1.526	0.290	19.00	81.5	51.88	9
01 x 290	372	8063	12.230	1.430	0.260	18.18	86.0	51.42	10
78 x 290	537	5520	8.379	1.405	0.283	20.14	81.0	51.01	11
74 x 290	491	7110	10.498	1.438	0.271	18.85	80.0	50.81	12
76 x 290	477	7466	10.866	1.386	0.267	19.26	79.5	50.46	13
81 x 290	498	3866	5.744	1.575	0.308	19.56	78.0	48.95	14
30 x 290	421	5813	8.536	1.438	0.286	19.89	78.5	48.49	15
17 x 290	374	7050	9.184	1.362	0.254	18.65	86.0	46.65	16
48 x 290	231	5600	8.567	1.552	0.299	19.27	73.5	44.37	17
22 x 290	414	6513	8.969	1.376	0.256	18.60	80.0	44.34	18
07 x 290	476	5903	8.367	1.340	0.260	19.40	77.5	44.26	19
26 x 290	429	6580	8.844	1.410	0.247	17.52	82.0	43.52	20

Table 12.Performance study & Ranking of the M x B hybrids based on the 2 croprearing conducted during Nov., 2017 & Feb., 2018

Avg. MTI- Average Multiple Trait Index

10.A.IV.3.2. AIB3578: Evaluation of exotic bivoltine silkworm breeds to identify promising parental genetic resources. (Apr., 2017 to Mar., 2019) [Collaborative with CSGRC, Hosur]

Kanika Trivedi, Director, CSR&TI, Berhampore (Project Coordinator).

Gopal Chandra Das (**PI**) & A. K. Verma, CSR&TI, Berhampore (M. Muthulakshmi, Veeranna Gowda and Anuradha H. Jingade and S. Nivedita, CSGRC, Hosur)

Objective: To identify bivoltine silkworm germplasm for specific qualitative and quantitative traits.

Progress:

Result in Table 13 showed that combination made with exotic Bv accession accessions 164, 197 and 232 performed very well as they positioned in top three ranks and mortality due to disease incidence were depicted in Fig.5.
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Fig. 5. Graphical presentation of mortality recorded during Nov., 2017 Crop due to disease incidence

Table 13.Ranking of the bivoltine hybrids based on the 2 crop rearing performanceconducted during Nov., 2017 & Feb., 2018

RACE	Fecundity	ERR no	ERR wt	SCW	SSW	SR%	Avg. MTI	Rank
164 x 291	627	6160	8.676	1.462	0.300	20.53	60.92	1
197 x 291	512	5320	7.235	1.450	0.315	21.69	57.79	2
232 x 290	538	5340	7.165	1.455	0.302	20.73	56.01	3
169 x 291	473	4320	6.224	1.465	0.321	21.92	55.94	4
50 x 291	540	6440	8.185	1.380	0.282	20.41	53.65	5
267 x 291	557	6920	8.742	1.299	0.271	20.82	52.74	6
154 x 290	533	3700	4.651	1.429	0.303	21.21	52.39	7
177 x 291	453	5340	7.070	1.387	0.300	21.60	52.38	8
163 x 290	629	5040	6.550	1.361	0.270	19.81	51.46	9
155 x 291	567	6920	8.294	1.309	0.261	19.94	50.65	10
201 x 290	469	4940	6.465	1.368	0.292	21.31	50.33	11
35 x 291	513	5280	7.297	1.458	0.277	18.96	50.04	12
225 x 290	507	2940	3.899	1.322	0.303	22.88	49.99	13
5 x 290	513	5140	6.198	1.368	0.263	19.23	45.79	14
268 x 291	574	5060	6.075	1.347	0.252	18.67	45.22	15
266 x 291	501	3600	5.072	1.396	0.273	19.53	44.99	16
143 x 291	540	2340	3.154	1.413	0.277	19.61	44.55	17
329 x 290	565	1640	2.522	1.415	0.267	18.83	42.04	18
13 x 290	524	1680	2.182	1.362	0.273	20.01	41.42	19
43 x 290	583	2650	2.993	1.272	0.251	19.73	40.31	20

Avg. MTI- Average Multiple Trait Index

A.K.Verma (PI), N.Chandrakanth and N.B.Kar.

Objectives: To develop Congenic multivoltine and bivoltine breed from developed converged gene pool as parent for high cocoon shell weight and horizontal tolerance, respectively.

^{10.}A.IV.3.3.AIB 3619: Development of silkworm (*Bombyx mori* L.) congenic breeds from a gene pool with higher genetic plasticity. (Phase-II). (Jul., 2017 to Jun., 2020).

- **Progress:** The following converged lines developed from the output of the previous phase of the project are
- In Bivoltine: (1) Plain (p) Larvae, Faint Constricted, White (c) colour Cocoon
 (2) Marked (+p) Larvae, Faint Constricted, White (c) colour Cocoon
- **In Multivoltine** (1) Plain (*p*) Larvae, Yellow (*C*), Oval shape Cocoon (2) Plain (*p*) Larvae, White (*c*), Oval shape Cocoon
 - (2) Plain (p) Larvae, while (c), Oval shape Cocoon
 - (3) Plain (p) Larvae, Light Greenish(Gr) Oval shape Cocoon

From above developed multivoltine & bivoltine lines following multivoltine Recurrent Backcross lines (RBL1) with high shell weight (>0.24g) and bivoltine RB lines (RBL1) with high survival (>90%) will be developed (Table 14 to 17).

 Table 14. Rearing Performance of Receptor x Donor (Multivoltine Congenic line)

 with High Shell Weight

Name	Multivoltine Receptor Parent	Bivoltine Donor Parent	RBL1 - BC F_Aug., 17 F ₃ ² -Nov.,17		
Cocoon Shape	Oval	Oval	Faint Constricted		
Cocoon Colour	Yellow	White	yellow		
Shell Wt. (g)	0.218	0.252	0.221		
	0.229	0.256	0.239		
Shell %	14.13	17.82	17.20		
	16.54	19.95	17.79		
Pupation%	92.33	89.33	90.00		
	87.33	90.67	88.33		

 Table 15.Rearing Performance of Receptor x Donor (bivoltine congenic line) with high survival

Name	Bivoltine Receptor Parent	Multiivoltine Donor Parent	RBL1 - BC F_Aug., 17 F ₃ ² -Nov.,17		
Cocoon Shape	Oval	Oval	Oval		
Cocoon Colour	White	Yellow	Light Greenish White		
Shell Wt. (g)	0.252	0.218	0.228		
	0.256	0.229	0.276		
Shell %	17.82	14.13	16.58		
	19.95	16.54	20.89		
Pupation%	89.33	92.33	90.33		
-	90.67	87.33	91.67		

 Table 16. Rearing Performance of Receptor x Donor (Multivoltine Congenic line)

 with High Shell Weight

Name	Multivoltine Receptor Parent	Bivoltine Donor Parent	RBL1 - BC F_Aug., 17 F ₃ ² -Nov.,17
Cocoon Shape	Faint Constricted	oval	Faint Constricted
Cocoon Colour	White	White	White
Shell Wt. (g)	0.165	0.252	0.219
	0.190	0.248	0.225
Shell %	12.28	17.82	16.43
	16.41	19.95	18.76
Pupation%	84.67	89.33	88.00
	90.00	90.67	92.00

 Table 17. Rearing Performance of Receptor X Donor (bivoltine congenic line) with high survival

Name	Bivoltine Receptor Parent	Multiivoltine Donor Parent	RBL1 - BC F_ Aug., 17 F ₃ -Nov.,17
Cocoon Shape	Oval	Oval	Faint constricted
Cocoon Colour	White	Light Greenish White	White
Shell Wt. (g)	0.252	0.165	0.245
	0.256	0.190	0.266
Shell %	17.82	12.28	17.07
	19.95	16.41	20.79
Pupation%	89.33	92.67	89.99
	90.67	94.00	92.00

RBL1s will be followed by development of RBL2s, RBL3s and ultimately Congenic lines.

10.A.IV.3.4.AIB 3616 : On farm trial of the breeds/ hybrids developed in the project AIB 3501. (Sept., 2017 to Dec., 2019).

A.K.Verma(**PI**), N. Chandrakanth, N.B.Kar, K.C.Barua, G.Singh, K.C.Brahma and EO., four DOS farm.

Objectives:

- To test the potentiality of the new improved multivoltine breeds/ hybrids developed in the concluded project-AIB 3501.
- To identify season specific silkworm hybrids for the plains of West Bengal, Jharkhand, Odisha and North-East states.

Progress: Following three new multi x bi hybrids have been taken for trial along with ruling hybrid as control. The details of the hybrids are shown in Table 18.

Multi x Bi	Fec.	S.C.W. (g)	S.S.W(g)	Shell %	ERR-no.	ERR-wt	Neatness
12(Y)x(B.Con.4x1)	506	1.720	0.336	19.55	9244	15.78	80
21(Y)x(B.Con.1x4)	495	1.605	0.327	20.38	9355	15.79	75
8(W)x(SK6x7)	510	1.769	0.349	19.73	8189	14.41	80
Nx(SK6xSK7)-C	382	1.366	0.209	15.30	9324	12.29	70

Table 18. Detail of the Multi x Bi hybrids tested

Progress:

- After P1 rearing hybrid dfls have been prepared and sent to REC, Bhandra; RSRS, Koraput and RSRS, Jorhat.
- Rearing has been completed in all the places.
- In West Bengal as the DOS farms could not take this rearing, test was undertaken at farmers' field. The detail of the first trial (Autumn) is depicted in Table 19 to 23.

Table 19. Perfo	rmance of hybrids	at Birbhum	(WB)
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Hybrids	Fec.	Hatch. %	Cocoon Yield/	SCW	SSW	SR%	Neat-	Rate
			100 dfl	gm	gm		ness	
8(W) x (SK6 x SK7)	341	98.00	46.00*	1.769	0.340	19.21	80	N.A.
12(Y) x (B.Con1 x B. Con.4)	432	98.00	62.50	1.807	0.339	18.76	78	Rs.18000/40kg.
21(Y) x (B.Con.1 x B. Con.4)	405	94.00	58.00	1.580	0.320	20.25	75	N.A.
N x (SK6 x SK7)- C1	352	94.00	50.50	1.655	0.262	15.83	70	Rs.16000/40kg
M6DPC x (SK6 x SK7)- C2	400	93.00	54.30	1.699	0.278	16.36	75	N.A.

Tuble 20. Reening periormance of hybrids at Bronam (WB)

Multi x Bi	Fl. length (m)	Fl. size (d)	Reel- ability (%)	Raw silk %	Neat- ness	Renditta	Recovery %
8(W) x (SK6 x SK7)	576	2.49	44.38	9.56	80	10.46	76.92
12(Y) x (B.Con.1 x B. Con. 4)	651	2.41	73.51	10.00	80	10.27	77.14
21(Y) x (B.Con.1x B.Con.4)	647	2.62	73.61	9.33	78	10.71	77.41
M6DPC x (SK6xSK7)	569	2.59	78	-	75	10.47	79
N x (SK6xSK7)	619	2.65	79	-	70	9.67	80

Table 21. Performance of hybrids at REC, Bhandra

Multi x Bi	Fec.	ERR-No.	ERR-wt	S.C.W. (g)	S.S.W (g)	Shell%	Neatness
21Y x (B.Con.1 x B.Con.4)	465	8759	14.69	1.71	0.29	17.19	75
12(Y) x(B.Con.4 x B.Con.1)	405	7483	12.82	1.62	0.27	16.66	75
8(W) x (SK6 x SK7)	360	8645	11.02	1.26	0.23	18.25	78
N x (SK6 x SK7)- C	402	9195	11.88	1.34	0.20	14.92	70

Multi x Bi	Fec.	ERR-no.	ERR-wt	S.C.W. (g)	S.S.W (g)	Shell%
21Y x (B.Con.1 x B.Con.4)	364	8164	13.60	1.52	0.25	16.36
12(Y) x(B.Con.4 x B.Con.1)	492	9622	15.89	1.53	0.27	17.63
8(W) x (SK6 x SK7)	402	8988	16.62	1.81	0.29	16.02
N x (SK6 x SK7)- C	435	9211	15.06	1.54	0.25	15.96

Table 22. Performance of Hybrids at RSRS, Koraput

Table 23. Performance of Hybrids at RSRS, Jorhat

Hybrids	Fec.	Hatching %	Cocoon yield/	ERR	SCW (g)	SSW (g)	SR%
			100 dfls				
8(W) x (SK6 x SK7)	341	98.00	42.00	8333	1.52	0.29	19.07
12(Y) x (B. Con.1 x B. Con.4)	385	97.30	38.00	8010	1.47	0.27	18.36
21(Y)x (B.Con.1 x B.Con.4)	388	90.85	38.00	7665	1.42	0.27	19.01
N x (SK6 x SK7)- C	352	92.50	38.60	7551	1.41	0.24	17.02

From first rearing it has been observed that in RSRS, Jorhat and Koraput, $8(W) \times (SK6 \times SK7)$ has performed better than others. Whereas in REC, Bhandra, $21(Y) \times (B.Con.1 \times B.Con.4)$ was the best and in Birbhum (WB), it was $12(Y) \times (B.Con.1 \times B.Con.4)$.

10.A.IV.3.5.AIB 3617 : Identification of region specific bivoltine hybrids suitable for highly fluctuating and seasonally variable climatic conditions of Eastern and North-Eastern India.(Phase-II) (**Apr., 2017 to Mar., 2020**).

V. Lkashmanan (**PI**), N. Chandrakanth (CI), Shri.N.B.Kar, G.Singh (RSRS, Bhandra), U.C.Boruah (RSRS, Jorhat) K.C.Brahma (RSRS, Koraput), Ranjit Kar (RSRS, Kalimpong) and Collin Z. Renthlei (REC, Shillong).

- **Objectives:** To identify new bivoltine hybrids with genetic plasticity to buffer against adverse climatic conditions of Eastern and North-Eastern India.
- Progress: Five each new oval and five dumbbell breeds developed through shuttle breeding approach involving six locations such as CSRTI, Berhampore, RSRS, Kalimpong, RSRS, Koraput, RSRS, Jorhat, REC, Bhandara, REC, Shillong have been maintained.

Hybrid studies are being carried out at CSRTI, Berhampore and two new single hybrids, namely, BHP-2 x BHP-8 & BHP-3 x BHP-8, based on rearing, cocoon and fibre parameters, out of twenty five new combinations evaluated along with two control hybrids, SK6 x SK7 and B. Con.1 x B. Con.4.

To identify new double hybrids, twenty oval foundation crosses and twenty dumbbell foundation crosses were evaluated. Based on rearing, cocoon and fibre parameters, three oval foundations crosses namely, BHP1 x BHP3, BHP3 x BHP2 & BHP4 x BHP3 and five dumbbell foundation crosses namely, BHP7 x BHP9, BHP8 x BHP7, BHP8 x BHP9, BHP9 x BHP6 & BHP9 x BHP7, were short-listed (Table 24). Fifteen new double hybrid combinations, utilizing these three oval foundation crosses and five dumbbell foundation crosses were evaluated and three double hybrid combinations, namely, (BHP1 x BHP3) x (BHP8 x BHP9), (BHP3 x BHP2) x (BHP7 x BHP9) and (BHP3 x BHP2) x (BHP8 x BHP9) were short-listed based on the rearing, cocoon and fibre parameters (Table 25).

As only two experimental rearing on bivoltines are being carried out at five other locations, the maintenance of newly evolved breeds is carried out and also, eight short-listed BHP breeds are supplied to them for further studies, which will be reared during Spring, 2018.

#	Hybrid	Fec	ERR	ERR	Single	Single	Shell	FI. length	Raw
		(No.)	(No.)	Wt. (kgs)	cocoon wt (g)	shell wt (g)	(%)	(m)	Silk (%)
1	BHP-2 x BHP-8	466	9120	15.200	1.633	0.302	18.49	870	13.50
2	BHP-3 x BHP-8	498	9260	15.010	1.591	0.304	19.10	898	14.05
	Avg.	482	9190	15.105	1.612	0.303	18.79	884	13.78
3	SK6 x SK7 – C1	478	9360	14.860	1.481	0.252	17.01	792	12.10
4	Bcon-1 x Bcon4 – C2	511	9020	13.710	1.520	0.270	17.76	850	13.20
Imp	rovement over C-1	0.82	-1.81	1.64	8.84	20.23	10.46	11.61	13.88
Imp	rovement over C-2	-5.67	1.88	10.17	6.05	12.22	5.79	4.00	4.39

Table 24.Performance of newly developed single hybrids at CSRTI, Berhampore

#	Hybrid	Fec	ERR	ERR	Single cocoon	Single shell	Shell	Fl. length	Raw
		(No.)	(No.)	Wt. (kgs)	wt (g)	wt (g)	(%)	(m)	Silk (%)
1	(BHP-1 x BHP-3) x	553	9260	15.320	1.583	0.306	19.33	896	14.70
	(BHP-8 x BHP-9)								
2	(BHP-3 x BHP-2) x	550	9080	14.040	1.528	0.289	18.91	874	14.38
	(BHP-7 x BHP-9)								
3.	(BHP-3 x BHP-2) x	570	9160	15.700	1.576	0.310	19.67	916	14.96
	(BHP-8 x BHP-9)								
Ave	g.	557	9166	15.020	1.562	0.301	19.27	895	14.68
4.	SK6 x SK7 – C1	478	9360	14.200	1.481	0.244	16.48	792	12.20
5.	B.Con.1 x B.Con.4-	511	9100	14.080	1.498	0.268	17.89	850	13.40
	C2								
Imp	provement over C1	16.52	-2.07	5.77	5.46	23.36	16.92	13.00	20.32
Imp	provement over C2	9.00	0.72	6.67	4.27	12.31	7.71	5.29	9.55

10.A.V. DISEASE AND PEST MANAGEMENT

10.A.V.1. BIOTECHNOLOGY SECTION

10.A.V.1.1. PIB3548: Evaluation of bacterial leaf spot resistant improved progenies of mulberry for field utilization. (Jan., 2016 to Dec., 2018).

S Chattopadhyay (**PI**- fr. 02.07.2017), **R** Banerjee (**PI**- upto 01.07.2017) and Pooja Makwana.

Objectives:

- Evaluation of bacterial leaf spot (BLS) resistant improved lines for foliage biomass and associated agronomic traits under RBD
- Silkworm bioassay of the promising lines for prospective commercial utilization
- Trait refinement of promising lines through sib-mating and development of third generation (F₂).
- Evaluation of bacterial leaf spot resistance of developed progeny (F_2) using identified SSRs to establish marker-trait link for MAS based utilization.

Assessment of BLS disease reaction, leaf biomass and associated traits: Eight promising bacterial leaf spot (BLS) resistant F_1 (pseudo- F_2) genotypes, high yielding parent S_1 , ruling cultivar S_{1635} and recommended C_{2038} were established under RBD for thorough evaluation of disease responsiveness, foliage biomass along-with various ancillary traits. The durability of these eight genotypes was already checked through potted plant assay under artificial inoculums and data presented previously.

The BLS disease reaction was assessed altogether five times symptomatically under the natural prevalence of the disease in field condition. The BLS severity varied significantly across the genotypes and about 1.3 to 1.6-fold less BLS severities were observed in the test genotypes than S_1 (Table 26).

0 11			1
Genotype / parent	DSI	Grade	Decrease over S-1 (fold)
BLSY-1	8.1	MR	2.2
BLSY-2	6.0	R	3.0
BLSY-3	7.8	MR	2.3
BLSY-4	11.2	MR	1.6
BLSY-5	9.2	MR	1.9
BLSY-6	5.2	R	3.5
BLSY-7	9.4	MR	1.9
BLSY-8	10.5	MR	1.7
M multicaulis	4.5	R	4.0
S-1	18.2	S	

Table 26.Mean leaf biomass of eight promising bacterial leaf spot resistant mulberry genotypes along with parents under field environment of Berhampore

Data are based on the mean of 5 rounds of BLS scores under natural epiphytotics (n=10)

After evaluation of pooled data of six rounds, significant variations were observed among eight test genotypes in respect of leaf biomass and ancillary traits like primary shoot length, leaf area, branch number and nodal distance. Two of the genotypes constantly exhibited ~4.0% to 12.8% more leaf biomass potential than the ruling cultivar C-2038 (Table 27). Improvement of primary shoot length (7%), leaf area (9%), and associated increase of total chlorophyll, sugar and protein contents were observed in the most superior genotype over the ruling cultivar C-2038 (biochemical data not shown).

Trait refinement of promising lines through sib-mating of identified F₁ **genotypes:**Completed second round of targeted crossing among four selected superior F₁ genotypes for the BLS trait improvement and collected seeds for strengthening already established nursery (~66 nos.). DNA profiling of previously developed BLS specific F₁ (pseudo-F₂) population (cross of S₁ x *M multicaulis*; 127 nos.) along with presently developed F₂ (pseudo-F₃) are under process to establish the link between maker and BLS resistant/susceptible trait.

Table	27.	Mean	seasonal	values	of	leaf	biomass	and	growth	parameters	of	better
		perfor	ming bact	erial lea	af s	pot re	esistant m	ulbe	rry geno	types at Inst	itut	te

Parent /		Leaf biomas	S	PSL	LA	PB	ND
progeny	g.plant ⁻¹	g.plant ⁻¹ Kg.ha ⁻¹ .y ⁻¹ % over C-203			(cm ²)	(no)	(cm)
BLSY-2	394.2	54747	4.0	137.7	231.5	9.1	4.10
BLSY-6	428.4	59498	12.8	142.2	240.4	10.4	3.78
S-1635	331.3	46072	-	133.2	196.5	9.5	3.80
C-2038	379.7	52739	-	132.2	222.2	10.2	4.02
LSD(0.05)	30.5	-	-	5.2	25.9	1.07	0.32
CV%	16.9	-	-	9.6	16.3	12.3	11.3

Data are mean of six seasonal data. BLSY-3 to BLSY-2 are two better performing genotypes;



Fig.6. Amplification of bacterial leaf spot responsive primer (MM-41) on F_1 mulberry progenies on 3% agarose gel. M= molecular marker of 50bp, R = resistant parent; S =susceptible and P = progenies.

DNA profiling of BLS specific progeny populations with SSRs: In our previous pilot study, we have identified a few BLS specific SSRs. These along with some other mulberry specific SSRs (altogether 22), generous gift from CCMB are under the process of utilization. So far, completed parental polymorphism study with 22 SSRs and seven showed parental polymorphism (data not shown). All 7 SSRs, polymorphic to parental clones were used for the DNA profiling of 127 F_1 populations and allelic variation was recorded. A representative performance of MM 41(a mulberry specific genic SSR) is presented in Fig. 6. The isolation of DNA from ~60 F2 (pseudo-F3) progenies was also completed.

10.A.V.1.2. PRE 3589: Assessment of designed antimicrobial peptides for mulberry protection against brown leaf spot and root rot: a biotechnological approach. (Oct., 2016 to Sept., 2019).

S. Chattopadhyay (PI), R. Banerjee (upto 01.07.2017) and P Makwana.

Objectives:

- Assessment of disease protection potential of synthetic antimicrobial peptides (AMPs) against *Myrothecium* leaf spot (MLS) and *Fusarium* root rot (FRR) of mulberry *in vitro*.
- Assessment of disease protection potential of selected AMPs against MLS and FRR *ex-vivo*.
- Determination of disease suppression ability of selected AMPs using quantitative PCR.
- Determination of the hemolytic activity of the selected AMPs against silkworm.

In order to assess the disease protection potential of designed AMPs against *Myrothecium* leaf spot (MLS) and *Fusarium* root rot (FRR) pathogens *in vitro*, synthesized some short peptides based on the sequences available in the public domains. The propagules of respective pathogens were collected from most frequently occurred local isolates in the mulberry fields. The culture procedures of *M. roridum* (causal organism of MLS) and *Fusarium solani* (causal organism of FRR) were standardized in potato dextrose agar (PDA) media.

In this period, we have tested four designed peptides (PRE 1 to 4) in a microdilution assay (dose: 10μ M, 25μ M, 50μ M, 75μ M, 100μ M, 125μ M, 150μ M and 175μ M) for their potential use in two pathogen growth suppressions *in vitro*. In this process, aseptically grown pathogen mycelia were collected from their respective actively dividing stages (Fig.7 a & b) in PDA media supplemented with streptomycin sulphate (20μ g ml⁻¹).



Fig.7. Characteristic growth pattern of a) Fusarium solani (5days after inoculation) and b) Myrothecium roridum (8 days after inoculation) local isolates used for AMP studies

In-vitro inhibition assays were performed in sterile flat-bottom 96-well polypropylene-plates with an assay load of 200µl per well. Spore concentration was determined and adjusted to 1.2×10^4 SFU ml⁻¹ with 2% of potato-dextrose broth. The final peptide concentrations were 10µM to 175 µM. The reaction plates were incubated at room temperature for 3d on a rotary shaker (300 rpm). The fungal growth was determined by measuring the OD_{590 nm} in a plate reader at specified time intervals.

Among the tested peptides so far, two (PRE- 3 and 4) did not show any MLS and FRR pathogen growth suppression abilities over the tested total range of concentrations of 10μ M to 175μ M. Two others (PRE 1 and 2) exhibited varying degrees of *F. solani* growth suppression abilities, of which PRE-1 showed maximum potential (Fig. 8a). While, PRE-2 showed maximum mycelial growth suppression ability to *M. roridum* (Fig. 8b).



Testing of other AMPs for the control of FRR and MLS pathogen in vitro is under progress.

10.A.V.2. SILKWORM PATHOLOGY SECTION

10.A.V.2.1. ARP3522: Isolation, cloning and characterization of antibacterial protein(s) from *Bombyx mori* L. (May, 2015 to Jun., 2018). (A collaborative project with SBRL, Kodathi, Bangalore).

K.Rahul (fr. 03.07.16) & S. Chakrabarty (upto 02.07.16) (**PI**), Z.Hossain and G.Roy (JRF), CSR&TI, BHB; G. Ravikumar, SBRL Kodathi, Bangalore.

Objectives: Isolation, purification and characterization of antibacterial protein fractions elicited against bacterial strain.

Progress: Full length cloning of lipoprotein gene was carried out by 5' and 3' RACE and sequence confirmed. The lipoprotein gene was cloned in *Pichia pastoris* for its recombinant expression. The transformed *Pichia pastoris* was subjected to liquid culture in selective medium and cell pellets and supernatants were collected at different time intervals. Proteins were extracted from both cells and supernatants. The recombinant expression of the protein will be confirmed by SDS-PAGE, western blot using anti histidine antibody, followed by antibacterial assay.

10.A.V.2.2. ARP 3590: Studies on the efficacy of phototrophic bacterial extracts as feed supplement for management of diseases in silkworm, *Bombyx mori* L. (Oct., 2016 to Sept., 2019).

K.Rahul (**PI**) and Zakir Hossain.

Objectives: To screen the efficacy of phototrophic bacterial extracts as feed supplements for disease management in silkworm.

Progress: The physiological and biochemical characterization of three bacterial strains belonging to the genera *Rhodovulum*, *Rhodobacter & Rhodopseudomonas* was carried out as mentioned in the Table 28.

Particulars	рН	Temp. (°C)	NaCI%	Preferred C	Preferred N source
			(w/v)	source	
Rhodovulum sp.	7	25	2	malate	ammonium chloride
Rhodobacter sp.	7	30	1	pyruvate	ammonium chloride
Rhodopseudomonas sp.	6	30	0	pyruvate	ammonium chloride

Table 28. Physiological and biochemical characterization of bacterial strains

Bulk growth of the above three strains was carried out following the standard physiological and biochemical conditions, feed supplement was prepared and the innocuous nature of the feed supplement was tested. The efficacy of the feed supplements employing all the above three bacterial cultures independently at different doses were also carried out. Based on the bioassay studies conducted with 4 breeds and 1 hybrid (SK6, SK7, B.Con.1, B.Con.4 and M.Con.1 x B.Con.4,), no toxic

effect of the feed supplement have been found and without any substantial difference in the survival, cocoon shell weight and filament length.

10.A.VI. BRIDGING GAP IN TECHNOLOGY ADOPTION

10.A.VI.1. PMCE DIVISION

10.A.VII.1. 1.MTS 3599: Study on mulberry sericulture production in West Bengal: a statistical approach. (Nov., 2016 to Apr., 2018).

G. R. Manjunatha (**PI**), Shafi Afroz, S. Chanda, D. Pandit and T. Datta Biswas.

Objectives:

- To analyze the trends in mulberry cocoon production in West Bengal.
- To estimate costs and returns of mulberry cocoon production.
- To assess resource use pattern and resource use efficiency of sericulture farmers.

<u>Progress:</u> Assessment of Economic Efficiency in Mulberry Sericulture at Murshidabad

- To accomplish the objectives of the study, the primary data were elicited from 80 farmers from Murshidabad district under *multistage random sampling* method.
- Data envelopment analysis was performed to analyze economic efficiency and draw the meaningful inferences.
- The efficiency analysis indicated in moriculture that 24.4 percent of farmers cultivating mulberry were found to have economic efficiency score of 0.90-1.0 and 37.5 percent of farmers were found to have efficiency score of 0.7-0.8. The mean efficiency score for the sample respondent was found to be 0.721 reflecting the existence of inefficiency to the extent 0.279 (27.90%).
- In case of sericulture, 24.4 percent of sample farmers were found to economically efficient with efficiency score of 0.9-1.0 and 31 percent of farmers possessing efficiency score of more than 0.8-0.9. The mean efficiency score was found to be 0.787 indicating the existence of inefficiency to an extent of 0.213 (21.30%).

10.A.VI.2. EXTENSION & PUBLICITY DIVISION

10.A.VI.2.1. MOT 3601: Skill Gap Analysis and Capacity Building of Sericulture Extension Workers and Farmers in Traditional and Non-Traditional States. (Nov., 2016 to Mar., 2018).

Shafi Afroz (**PI** - upto Jan., 2018), Manjunatha G. R. (**PI** -fr. Feb., 2018), T. Dutta Biswas, D. Das, D. Pandit and B. C. Ray.

Objectives:

- To document job profile of the extension workers involved in sericulture activities and their engagement for each of the activity.
- To identify the skill requirements for the extension workers and farmers for each activity.
- To determine the skill gap of the extension workers and farmers involved in different sericulture activities.
- To design capacity development programme to target the skill requirements of the extension workers and farmers.

Progress: In order to document the job profiles of the extension workers based on the mandates of Central Silk Board and needs of the farmers, sericulture experts had recommended eight roles which were prioritized by applying Garret ranking technique. The suggested roles were:

- To conduct front line demonstration of new technologies at the farmers' level on their farm.
- To conduct survey of the sericultural farmers' field and crops regularly.
- To act as resource person for the information about sericulture and modern technologies.
- To organize extension communication programme for the new methods and technologies.
- To organize human resource development programme to supports the current and future needs of the farmers.
- To get the feedback for the adopted technologies from the farmers and convey same to the experts.
- To coordinate with other departments for satisfactory working relationships of the institute and farmers.
- To prepare technical report for the conducted programmes and other activities.

Similarly, all the skills required for modern sericulture practice were identified for mulberry cultivation as well as silkworm rearing. Based on the necessary skills, skill gap for the extension workers were identified. It was found that for most of the skills of sericulture, extension workers were skill deficient. Hence, there is requirement of intensive training of the extension workers for development of sericulture.

10.A.I.6.RSRS. KORAPUT, ODISHA

10.A.I.6.1. MOE-3604: Yield gap analysis in mulberry leaf and cocoon production-A study in Eastern Ghat Highland zones of Odisha. (Dec., 2016 to Nov., 2018).

K.C Brahma (PI), S.K Misro and S.B Dey.

Objective:

- To assess the magnitude of 'Yield Gap' in respect of mulberry leaf and cocoon productivity at farmers' level.
- To examine the nature of variation in 'Yield Gap', across different socioeconomic strata of the sericultural farmers.
- To identify factors influencing for 'Yield Gap'.
- To suggest policy measures for reducing the gap
- **Progress:** Targeted blocks, villages and farmers have been identified in Rayagada, Koraput and Keonjhar districts (Table 29). Collection of data with personal interview from the study area.

Rayagada			Koraput	Keonjhar		
#	Village	#	Village	#	Village	
1	Bhagamunda	1	Sukariguda	1	Ambuapada	
2	Prajashila	2	Bayaput	2	Bholbeda	
3	Kumbharshila	3	Sagar	3	Dalangpani	
4	Ratapada	4	Nuagaon	4	Raikudar	
5	G.Rautaghati	5	Kanagaon	5	Muktapur	
6	Siriguda	6	Dumuriput	6	Kotrabeda	
7	Champajodi	7	Podagada	7	Gopopur	
8	Talamaligaon			8	Saraskola	

Table 29. Name of the villages targeted for the survey

10. B.CONCLUDED RESEARCH PROJECTS 13 Nos (Proj.- 11 nos.; P.S.-1 no. & Prog.-1 no.)

#	Code	Title	PI of the Proj /prog.
1.	PIB 3481	Evaluation of mulberry varieties suitable for low in- put soil. (Jan., 2013 to Dec., 2017)	D. Chakravarty, Scientist-D
2.	PIN 3587	Improvement of leaf quality and productivity through external application of seaweed extracts in mulberry (<i>Morus alba</i> L.) (Oct., 2016 to Sept., 2017)	A. Pappachan, Scientist-B
3.	PPE 3517	Population Interaction of pest and natural enemies in mulberry ecosystem. (Aug., 2014 to July, 2017) (Collaborative with NBAIR, Bangalore)	S. Chanda, Scientist-D
4.	PRE 3533	Incidence of whitefly in mulberry germplasm accessions. (Mar., 2015 to Feb., 2018)	S. Chanda, Scientist-D
5.	AIB 3547	Development of high temperature and high humidity tolerant bivoltine breeds of silkworm (<i>Bombyx mori</i> L.) (Jul., 2015 to Jun., 2017)	N. Chandrakanth, Scientist-B
6.	AIB 3514	Development of multivoltine based congenic /NIL breed of silkworm (<i>Bombyx mori</i> L.) through introgression of " <i>Id</i> " gene and its uses. (Jun., 2014 to May, 2017)	A.K. Verma Scientist-D
7.	AIB 3545	Authorization Trial of Silkworm hybrids in Eastern and North Eastern India. (Aug., 2015 to Mar., 2018) [Collab. with NSSO, Bangalore and CSTRI, Bangalore]	A.K. Verma Scientist-D
8.	PPS 3559	Testing of carbon capturing potential in mulberry in different location. (Apr., 2015 to Mar., 2018)	D. Chakravarty, Scientist-D
9.	PPA 3499	Evaluation of field level performance of Vishala mulberry variety in different locations under irrigated conditions in West Bengal. (Apr., 2013 to Mar., 2018)	G.C.Das, Scientist-D
10.	AIT 3557	Conduct multi-locational trial on transgenic Bm NPV resistant silkworm strains to establish their efficacy and generate data for their regulatory approval. (Jan., 2016 to Aug., 2017) (Collabo. with APSSRDI, Hindupur, AP)	G.C.Das, Scientist-D
11.	PIB 3521	Assessment of promising powdery mildew resistance lines for perspective commercial use. (Jan., 2015 to Dec., 2017)	S. Chattopadhyay, Scientist-D
12.	BPI (PS) 010	Identification of bio-chemical markers for thermo- tolerance in silkworm (<i>Bombyx mori</i> L.) (Oct., 2016 to Sept., 2017)	P. Makawana, Scientist-B
13.	B-JRH (P) 040	Studies on mulberry germplasm in agroclimatic condition in North East States. (Apr., 2015 to Aug., 2017)	M. Pamehgam, Scientist-C

10.B. I.MAIN INSTITUTE

10.B.I.1. MULBERRY BREEDING & GENETICS SECTION

10.B.I.1.1. PIB 3481: Evaluation of mulberry varieties suitable for low in-put soil. (Jan., 2013 to Dec., 2017).

D. Chakravarty (**PI** –fr.14.07.2016), M. K.Ghosh (**PI** -up to 31.03.2016), P. K. Ghosh (up-to 30.06. 2017), K. Suresh, S. K. Dutta (up to 31.04.2017), S.Chanda, A.K.Verma, S.N. Gogoi (RSRS-Jorhat), S.K. Misro (RSRS-Koraput), G. S. Singh (REC, Bhandra).

- **Objective:** To evaluate newly evolved promising mulberry varieties suitable for low input soil.
- **Progress:** High yielding mulberry varieties are not responsive well to low fertility and rainfed condition, result in poor yield and do not become lucrative to the farmers. Breeding high-yielding and nutrient-efficient cultivars is one strategy to simultaneously resolve the issues of resource shortage & environmental pollution, in addition to higher yield with fertilizer use efficiency. Sericulture is confined to the weaker sections of the farming community in India and West Bengal in particular. Application of chemical fertilizers was found to be the major constraint to the marginal farmers due to the high cost.

The evolved promising seven test genotypes *viz.*, C-1, C-2, C-3, C-4, C-5, C-6 and C-9 along with the check S-1635 were systematically evaluated for leaf yield and yield contributing parameters, adaptability and suitability for silkworm through bioassay study.

Test center	State	Test	Dose of NPK	Spacing	Transplantation
		condition		(cm)	(month)
CSR&TI, Berhampore	West Bengal	Irrigated	Full & half dose NPK	60 × 60	Sept., 2013
RSRS Koraput	Odisha	Rainfed	Full dose of NPK	90 × 90	March, 2013
RSRS Jorhat	Assam	Rainfed	Full dose of NPK	90 × 90	Sept.,2013
REC, Bhandra	Jharkhand	Rainfed	Full dose of NPK	90 × 90	Sept.,2013

NPK-Nitrogen, Phosphorus & Potash

The experiment was laid out in Randomized Block Design (RBD) with three replications under two set of conditions *i.e.*, full and half the recommended dose of NPK fertilizer (336:180:112 kg NPK/ha/yr. and 168:90:56 kg NPK/ha/yr., respectively) at CSR&TI, Berhampore. The test genotypes were also evaluated at three other test centers viz., RSRS-Jorhat (high rainfall humid climate), RSRS-Koraput (low rainfall dry climate) and REC (SU) - Bhandra (drought prone areas of Jharkhand), to assess the

performance and adaptability under rainfed condition (applying the recommended dose *i.e.*, 150:50:50 kg of NPK/ha/y) [Table 30].

Geno-	Condi-	Leaf yield	DHS	PH	NPS	TSL	ID	LS	MC	MC 6hrs
type	tion	(kg/ha)	(%)	(cm)	(Nos)	(cm)	(cm)	(%)	(%)	(%)
C-1	FD	44326	9.38	135	7.51	907	4.06	10.01	79.27	73.29
	HD	27235*	9.13	121	6.03	752	4.19	7.33	77.55	72.97
C-2	FD	45822*	9.40	136	8.02	918	3.84	9.51	78.63	72.16
	HD	28809*	9.62	125	6.26	799	4.06	7.71	77.43	72.58
C-3	FD	47675*	8.76	146	9.08	1007	4.16	8.51	79.92	74.48
	HD	30470*	8.96	133	7.08	842	4.42	6.03	78.41	73.79
C-4	FD	44666*	9.38	133	7.47	872	4.47	9.61	77.38	71.17
	HD	27753*	9.16	126	6.00	718	4.62	8.49	77.33	72.31
C-5	FD	49764*	8.67	152	9.67	1066	4.35	6.69	80.01	74.49
	HD	31948*	8.49	138	7.25	864	4.52	6.44	78.85	73.68
C-6	FD	43862	9.71	139	8.00	904	4.53	9.13	78.03	73.09
	HD	27604*	9.38	117	6.76	772	4.48	7.85	75.79	71.03
C-9	FD	49899*	8.62	159	10.77	1137	3.98	8.04	79.93	75.26
	HD	34007*	8.44	143	8.35	929	4.18	6.55	80.18	75.44
S -	FD	44131	9.71	131	8.57	971	4.65	12.62	79.34	74.42
1635	HD	26846	9.69	119	7.15	708	4.53	10.89	78.65	73.59
CD@	FD	151	0.36	2.37	0.35	21	0.12	0.79	0.35	0.84
5%	HD	106	0.30	2.46	0.32	21	0.08	0.54	0.47	0.48
CV	FD	4.38	9.43	4.14	9.95	5.33	6.81	33.70	1.06	1.10
	HD	4.96	7.71	4.74	11.73	6.65	4.10	29.19	1.46	1.59

 Table 31. Mean values for test genotypes for leaf yield and yield contributing parameters under irrigated condition at CSRTI, Berhampore

DHS (Days to 100% sprouting), PH (Plant height), NPS (No of primary shoots per plant), TSL (total shoot length), ID (inter nodal length.), LS(leaf senescence, MC (moisture content) and MC 6hrs(moisture content after six hours, FD(full dose) and HD(half dose)

The leaf yield and yield contributing parameters of test genotypes were recorded for three years covering fifteen crops at irrigated and nine crops at rainfed test centers. Analysis of variance revealed significant differences between the genotypes for all the characters studied under both the test conditions. The variation due to years was maximum for leaf yield under half dose, while in full dose variation due to seasons was highest. The mean leaf yield and yield contributing parameters of the test genotypes along with check variety (S-1635) in full dose and 50% dose of NPK under irrigated condition is depicted in Table 31.

Among the genotypes tested, C-9 had significantly higher values for annual leaf yield 49899 kg/ha followed by C-5(49764 kg/ha), C-3(47675 kg/ha), C-2(45822 kg/ha) and C-4(44666 kg/ha) under full dose of NPK. However, under 50% reduced NPK fertilizer application, all test genotypes recorded significantly higher values than check S-1635, which ranged from 27235 to 34007 kg/ha/y. The leaf yield improvement in C-9 was to a tune of 27% and 13% over the check S-1635 under 50% and 100% NPK fertilizer

application. The percentage leaf yield reduction was lowest in C-9 (by 31.8%) compared to check S-1635(by 39.2%) with 50% reduction of fertilizer dose. The mean values of growth and leaf parameters recorded were higher in full dose of NPK fertilizers over the 50% dose except for inter-nodal distance. The coefficients of variation for PH, NPB and TSL were significantly higher under HD than for FD, suggesting larger differences among genotypes in the responses to rate of NPK application. However, the results of the present study suggested that, in Eastern and North-Eastern India, mulberry leaf productivity can be achieved to an extent of 34-35 t/ha/yr. (26–27% over S-1635) with 50% reduced NPK fertilizer input under irrigated condition, if C-9 cultivar is used. The five season pooled data showed that during favorable crop season(July) under half dose of NPK fertilizer, C-9 had the highest performance (7687 kg/ha/crop) followed by C-5 (7183 kg/ha), C-3(6731 kg/ha) and C-2(6315 kg/ha). The cultivated triploid variety S-1635 had the poorest performance with the lowest yield (5930 kg/ha) (Fig.9).



Fig. 9. Seasonal performance of test genotypes under 50% of NPK dose in irrigated condition.

Genotypes	REC-BND	RSRS-JHT	RSRS-KPT	Pooled
C-1	11427	9693	11270	10797*
C-2	11134	9495	12641	11090*
C-3	12632	11845	15845	13441*
C-4	11271	10247	13459	11659*
C-5	12696	12575	14561	13277*
C-6	12171	9329	12703	11401*
C-9	12810	13254	16014	14026*
S1635	10990	10347	11518	10952
CD@ 5%	86	83	119	96

Table 32. Mean leaf yield of test genotypes under three rainfed test centers

REC-research Extension centre, RSRS-Regional sericultural research Station, BND-Bhandra, JHT-Jorhat, KPT-Koraput

Among the test genotypes evaluated under rainfed test centers, C-9 showed significantly highest leaf yield (14026 kg/ha/y) followed by C-3 (13441 kg), C-5 (13277 kg), C-4 (11659 kg) and C-6 (11401 kg) [Table 32]. The leaf and growth parameters recorded showed wide variation among the test genotypes.

Table 33. Initial and final status of available soil N, P and K (kg/ha) at HD plot of
CSR&TI, Berhampore

Test center	Condition	N	Р	K
HD plot CSR&TI,	Initial (Simulated, before initiation of the project)	218	33	362
Berhampore	Final (after completion of the project)	156	21	273

Analysis of soil NPK status at plantation and after final harvesting of the experimental plot applied with reduced dose of NPK fertilizer during the project period revealed that, reduced fertilizer application had reduced the availability of NPK in the soil substantially (Table 33). Hence, it clearly indicates that under such a NPK stress condition, the genotype C-9 showed significant superiority over the check S-1635 in terms of leaf productivity.

Silkworm (M.Con.1 x B.Con.4 hybrid) rearing was conducted with the leaves of all the test genotypes including check S-1635 (Table 34).

Under both the conditions (half and full dose of NPK application), the performance of C-9 on most of the rearing parameters was found at par with the Check S-1635.

No significant difference was observed between the test genotypes and the check in terms of Leaf spot disease occurrence. However, in C-9 Powdery mildew occurrence was observed significantly lower than the check S-1635 (Table-35).

Whitefly, thrips, mealy bug and Bihar hairy caterpillar infestation was observed in the test genotypes, which was significantly lower than the check and the values were found below ETL (Table 36).

Geno- type	Coc weig	oon ht(g)	Sh weig	ell ht(g)	Shell %		ERR No.		EF weigł	RR ht(kg)	Leaf to cocoon ratio	
	FD	HD	FD	HD	FD	HD	FD	HD	FD	HD	FD	HD
C-1	1.560	1.31	0.198	0.192	15.26	14.92	8067	7367*	10.2	9.6*	21.20	24.11
C-2	1.570	1.38	0.241	0.183	15.44	15.26	7067	6033	9.6	7.9	22.00	23.98
C-3	1.537	1.39	0.238	0.191	15.96	15.06	8790	7912*	12.1	9.8*	21.00	22.89
C-4	1.551	1.38	0.216	0.205	16.43	16.08*	7633	7433*	10.4	9.8*	22.10	23.09
C-5	1.501	1.42	0.241	0.231	17.84*	16.14*	8001	7400*	12.3	10.3*	20.10	20.91
C-6	1.580	1.49	0.241	0.209	16.38	15.86	7133	5400	9.4	8.6	20.80	20.67
C-9	1.577	1.43	0.215	0.209	15.89	15.34	8367	6567	11.9	8.5	20.20	22.02
S 1635	1.596	1.45	0.223	0.223	15.83	15.35	8767	6266	12.7	8.8	21.30	23.22
CD@ 5%	0.58	0.17	0.034	0.031	0.78	0.70	254	210	0.98	0.81	0.42	0.34

 Table 34.Silkworm bioassay results of M.Con.1 x B.Con.4 fed with the test genotypes

 & check

FD-full dose, HD-half dose, ERR-Effective rate of rearing

Genotype	MLS(Sept.)	PLS (Nov.)	BLS(July)	PMLD	PMLD (Feb.)		
-	FD	HD	FD	HD	FD	HD	FD	HD		
C-1	1.44	2.89	9.93	8.88	4.17	3.38	6.61	6.01		
C-2	2.66	4.15	11.36	6.53	3.43	2.85	5.86	1.27		
C-3	3.99	1.67	8.39	5.85	2.54	1.96	4.27	1.37		
C-4	2.10	0.78	9.55	6.38	3.76	2.51	4.41	2.00		
C-5	2.46	2.28	6.76	7.10	3.91	2.32	4.35	1.59		
C-6	1.38	1.73	8.53	7.49	2.93	2.55	5.05	3.11		
C-9	1.84	1.41	4.49	3.52	2.37	1.01	3.46	1.08		
S-1635	4.85	2.26	10.51	12.27	4.25	3.12	6.17	4.49		
CD@ 5%	NS	NS	NS	NS	NS	NS	1.80	2.83		

 Table 35. Season-wise mean PDI of foliar disease at CSR&TI, Berhampore

FD-full dose, HD-half dose, LS-Leaf spot

Table	36.	Season-wise	mean foliar	pest incidence	at CSR&TI,	Berhampore
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Genotype	White fly (No. of adult/leaf)		Thı (No. of r lea	rips lymphs./ af)	Tu (%	kra %)	BHC (No. of leaf infested /plant)		
	FD HD		FD	HD	FD	HD	FD	HD	
C-1	5.61	2.84	2.29	1.25	3.69	2.10	0.45	0.35	
C-2	5.96	3.41	2.89	1.30	4.59	2.40	0.85	0.56	
C-3	4.69	2.55	2.64	1.00	5.11	3.01	1.24	1.12	
C-4	5.89	2.38	3.03	0.85	3.01	1.11	0.56	0.45	
C-5	6.66	3.46	3.79	1.45	2.72	1.21	0.50	0.26	
C-6	4.48	2.44	2.95	1.01	3.60	1.45	1.20	0.84	
C-9	3.00	3.12	2.61	1.23	3.39	1.25	0.46	0.38	
S 1635	6.16	4.50	3.91	2.01	6.87	3.56	1.85	1.45	
CD@ 5%	1.24	1.20	0.58	0.46	1.20	0.86	0.45	0.36	

FD-full dose, HD-half dose

Conclusion: Based on three year data, genotype C-9 recorded highest annual leaf yield (49.89 & 34.01 t/ha/yr.), which is 13% & 27% higher over S-1635 under full and half NPK dose, respectively. Under rainfed condition, the C-9 was found to be superior with average leaf yield 14.02 t/ha/yr., which is significantly 28% higher over S-1635. So far as the bioassay parameters are concerned, the study revealed that the performance of C-9 was found at par with that of the Check, S-1635.

Future plan of work: The identified high yielding mulberry genotype, **C-9** for low NPK fertilizer input condition, in Eastern and North-Eastern India may be recommended for authorization and it can be released for commercial exploitation by the desired farmers.

10.B.I.2. AGRONOMY AND SOIL SCIENCE SECTION

10.B.I.2.1. **PIN 3587:** Improvement of leaf quality and productivity through external application of seaweed extracts in mulberry. (**Oct., 2016 to Sept., 2017**).

Anil Pappachan (PI), R. Mahesh and N. Chandrakanth.

Objectives:

- To determine the effect of application of seaweed extracts on growth and biomass in mulberry leaves.
- To standardize the dosage and time interval for the application of seaweed extract.
- To determine the effect of application of seaweed extracts on foliar diseases of mulberry.
- To perform bioassay on silkworm larvae fed with seaweed extract treated mulberry leaves.

Progress: Field experiment was conducted during July to Sept. to assess the effect of different concentrations of single and double applications (Table 37) of commercially available seaweed extracts from *Ascophyllum nodosum* and *Kappaphycus alvarezii* on the leaf yield and quality of mulberry. Foliar application of *A. nodosum* extract @ 0.5 ml /L and 2.0 ml /L (21 and 28 Days After Pruning-DAP); and *K. alvarezii* extract @ 0.5 ml /L and 1.0 ml /L (21 and 28 DAP) significantly increased the leaf yield by 11.16 %, 16.90 %, 10.30 % and 10.86 % respectively over control (328.33 g/plant), however all the four treatments were statistically on par with each other (Table 38). Leaf quality parameters *viz.*, Moisture content (%), Chlorophyll content (μ g/cm²), Protein content (mg/g of FW) was at par with control. Tukra incidence, whitefly incidence and *Myrothecium* leaf spot incidence were observed which were either at par with control or below ETL level (Table 37).

	Treatment	Leaf yield	Moisture Content	Protein content	Chlorophyll content	Tukra (%)	Whitefly per leaf	MLS (PDI)
		ber brant	(%)	(mg/g of FW)	(µg/cm²)	(/•)	(No)	(,
n	0.5ml on 21 & 28 DAP	365.00*	75.07	37.11	12.75	18.80	7.13	1.47
A. Ddos	2 ml on 21 & 28 DAP	383.83*	74.50	35.01	12.76	6.80	6.67	1.43
ш	0.5 ml on 28 DAP	345.00	74.40	34.38	12.63	10.23	5.73	1.43
Zť	0.5ml on 21 & 28 DAP	362.17*	75.27	38.63	12.03	13.21	5.87	1.80
K. vare	1.0 ml on 21 & 28 DAP	364.00*	74.23	38.86	13.00	16.40	5.57	2.00
al	1.0 ml on 28 DAP	342.50	74.47	38.01	13.57	9.30	6.40	1.85
Control		328.33	73.60	35.18	12.43	12.62	5.83	1.03
SEm±		9.76	0.54	1.28	0.40	3.5	0.51	0.25
CD@ 5	%	30.08	NS	NS	NS	NS	NS	NS

 Table 37. Effect of seaweed extracts on leaf yield, quality, pest and disease and disease incidence

Bioassay on silkworm was conducted using B.Con.1 x B. Con. 4 during Sept., 2017. Larval weight (g), ERR (No.), ERR (Wt.), Single Cocoon weight (g), Single Shell Wt.

(g) and Shell % were found to be at par with the control and no significant differences were observed (Table 38).

	Treatment	Larval weight (g)	ERR NO.	ERR Wt. (Kg)	Single Cocoon Wt. (g)	Single Shell Wt. (g)	Shell %
n	0.5ml on 21 & 28 DAP	3.57	9123	13.29	1.42	0.236	16.56
A. Ddos	2 ml on 21 & 28 DAP	3.83	8649	12.22	1.37	0.226	16.14
ис	0.5 ml on 28 DAP	3.80	9404	13.17	1.35	0.223	16.44
Zć	0.5ml on 21 & 28 DAP	3.83	9105	12.77	1.38	0.226	16.09
K. vare	1.0 ml on 21 & 28 DAP	3.73	9193	12.60	1.43	0.236	16.80
al	1.0 ml on 28 DAP	3.90	9035	13.90	1.39	0.233	16.87
Contro		3.63	9228	13.95	1.49	0.246	16.32
SEm±		0.69	216	0.83	0.02	0.01	0.42
CD@ 5	5%	NS	NS	NS	NS	NS	NS

Table 38. Effect of seaweed extracts on silkworm rearing

Economic analysis revealed that application of *A. nodosum* extract @ 0.5 ml /L at 21 and 28 DAP was most suitable for increasing leaf yield in mulberry with a cost benefit ratio of 1:1.67.

10.B.I.3. ENTOMOLOGY SECTION

10.B.I.3. 1. PPE 3517: Population interaction of pest and natural enemies in mulberry ecosystem (Aug., 2014 to July, 2017). [Collaborative with NBAIR*, Bangalore]

S.Chanda (PI), D.Das, U.C.Baruah, R.Kar, Ankita Gupta*, Pratheepa*.

Objectives:

- To study the population interactions of host plant, major mulberry pests and their natural enemies and correlation with abiotic factors.
- Studies on the biological attributes of the parasitoids.

Progress:

- > Tritrophic interactions among host plant, pests and natural enemy complex.
 - The study was carried out in four districts each of West Bengal, RSRS Jorhat and RSRS Kalimpong.
 - The seasonal incidence of major mulberry pests *viz.*, thrips, mealy bug, whitefly were studied along with their natural enemies at fortnightly intervals. The data were correlated with meteorological factors. The life stages of the pests were collected from the field and screened in the laboratory for emergence of parasitoids and predators. Incidence of root mealy bug was recorded only in Kalimpong.





Fig.10. Sampling scheme followed for data collection

> Studies on the biological attributes of the parasitoids.

- Studies on the biology of parasitioids including their life cycle, longevity, mating, oviposition, parasitization ability and parasitization behaviour were done by following established procedure suggested by Sathe and Santhakumar (1992). Host (mealy bug) cultures were established in the laboratory.
- For conducting fecundity studies, *Encarsia* spp. the parasitoids were released in a cavity block containing egg masses and nymphal stages of mealy bug. Daily observations were made for detecting dead nymphal and adult females of mealy bug.

Results: Three years pooled data revealed the following:

I. Population interaction of host plants, major mulberry pests and their natural enemies and correlation with abiotic factors:

At West Bengal, The highest population of thrips during April as observed from three years compiled data is due to favourable maximum temperature of 38° C and rise of minimum temperature from 15° C in March to 20° C in April apart from occasional rainfall of 8 mm to 29.19 mm.

This is supported by step-wise regression analysis which shows positive contribution of maximum temperature on incidence of thrips [R = 0.66 in Birbhum, R = 0.36 in Murshidabad, and R = 0.427 in Nadia] and maximum and minimum temperature in Malda (R = 0.64).

The highest population of white fly was recorded during Oct. in W.B. (14 No./leaf) when rainfall decreased to 18 mm RH was 49%, minimum temperature was 18° C. In Aug., Sept. and Nov. the white fly incidence was noted as 9, 10 and 10 No./leaf respectively. The nymphs laid during winter season emerge in March due to favourable weather i.e. maximum temperature of 35° C, minimum temperature of 15° C and 32% min.humidity and occasional rainfall of 11 mm. Min. humidity below 50 suppresses the white fly population which started to decrease from Nov. to May. Rainfall of 144 mm in Sept. apart from min. temp. of 22° C and min. humidity 54% created favourable atmosphere for enhancing white fly population of the following month *i.e.* Oct.

Minimum humidity shows a significant positive correlation with the incidence of white fly. Step-wise regression analysis also supports this view indicating the result *i.e.* R = 0.40 in Birbhum, R = 0.39 in Murshidabad, R = 0.506 in Malda and R = 0.519 in Nadia.

Mealy bug population starts from April (4 No./shoot) when maximum temperature shows 38°C and maximum humidity is 93%. The incidence of mealy bug gradually increases from May (8 No./shoot) when both maximum and minimum temperature increase. The highest incidence was observed during June (10 no./shoot) when maximum temperature was 38.45°C and maximum humidity 93.17%. From July due to heavy rainfall (231 mm) the population decreases.

Step-wise regression analysis supports the view of positive and significant attribution of maximum and minimum temperature on incidence of mealy bug showing the value of R = 0.48 in Birbhum, R = 0.514 in Murshidabad, R = 0.531 in Malda and R = 0.508 in Nadia (Table 39 & 40, Fig.11).

At Kalimpong, root Mealy Bug was found highest during Aug. (14 No./plant) followed by 12 No./plant during Sept. and lowest infestation was found in Jan.-Mar. i.e. 1 No./plant. The abiotic factors like maximum temperature of 29°C (Aug.) and 30°C (Sept.), maximum humidity of 99% (Aug.) and 97% (Sept.) helped in population build up of root mealy bug. Heavy rainfall of 517 mm could not affect the population of root mealy bug as it remains under soil (Table 41 and Fig.12).

At Jorhat, thrips infestation was less varied from 2-4 No./leaf w.e.f. Feb. and Apr. to Oct.. White fly was observed highest i.e. 15 No./leaf during Oct. followed by 13 No./leaf in Nov. Lowest white fly was seen 2 No./leaf in Apr. Mealy bug was observed 4-6 No./shoot during Feb. and Apr. to Nov. Natural Predator was found 2-3 No./plant throughout the year. Statistical analysis revealed that increase of minimum temperature holds positive and significant relationship with the population of thrips and mealy bug in Jorhat which is supported by step-wise regression (R=0.63 and R = 0.66, respectively) [Table 42 and Fig.13].

II. Biological attributes of the parasitoids:

It was observed that the gravid females of *Encarsia* spp. laid eggs on the mealy bug colony. Second/third instar grubs of female mealy bug were pierced at the ventral side by the ovipositor of adult *Encarsia* spp. This is due to consumption of nutrient from host body. It led to mortality of the mealy bug nymphs [Table 43].



Table 39. Seasonal occurrence of major pest population on mulberry ecosystem of
West Bengal (2014-2017)

Month	Thrips	Whitefly	Mealy bug	Natural Predators
	(Avg. no. per leal)	(Avg. 110. per leal)	(Avg. no. per shoot)	(Avg. 110.)
Jan.	0.00	0.00	0.00	1.25
Feb.	0.31	0.00	0.00	2.25
Mar.	6.06	2.04	0.00	2.50
Apr.	19.00	0.79	3.75	2.25
May	10.87	0.25	7.59	1.75
Jun.	4.17	0.50	9.95	3.33
Jul.	5.17	4.15	6.08	2.22
Aug.	2.75	8.41	1.00	2.25
Sep.	0.92	9.60	0.75	1.75
Oct.	0.25	13.70	0.00	1.25
Nov.	0.00	9.28	0.00	1.25
Dec.	0.00	2.08	0.00	2.00
Mean	4.13	4.23	2.43	2.00
Range	0-19.00	0-13.70	0-9.95	1.25-3.33

 Table 40. District-wise correlation and regression analysis between infestation of major mulberry pests and weather factors (West Bengal)

District	X 1	X 2	X 3	X 4	X 5	Model	P-value	R	Adj. R ²
Thrips (Avg. r	io. per lea	f)							
Birbhum	0.543**	0.264	-0.226	-0.317	-0.154	Y= -32.04 +1.254X ₁ -	0.000	0.66	0.41
Murshidabad	0.357*	0.333*	-0.282	-0.093	-0.096	Y= -17.354 +0.642 X ₁	0.033	0.36	0.10
Malda	0.462**	0.310	-0.057	-0.104	-0.096	Y= 2.238+0.336X ₁ + 0.434X ₂ -0.326X ₃	0.001	0.64	0.35
Nadia	0.427**	0.412*	-0.143	-0.165	-0.034	Y= -16.774 +0.610 X ₁	0.009	0.42	0.16
Whitefly (Avg.	no. per le	eaf)							
Birbhum	0.071	0.222	0.021	0.398*	0.261	Y= -0.422 +0.145 X ₄	0.016	0.40	0.13
Murshidabad	0.094	0.155	0.221	0.388*	0.089	Y= -2.366 +0.133X ₄	0.019	0.39	0.12
Malda	0.113	0.038	0.353*	0.380*	0.169	Y= -9.377 -0.443X ₂ +0.399X ₄	0.008	0.50	0.21
Nadia	0.020	0.204	0.516**	0.519**	0.244	Y= -4.824 +0.254X ₄	0.001	0.51	0.24

Mealy Bug (A	vg. no. p	er shoot)							
Birbhum	0.480**	0.458**	0.286	0.318	0.169	Y= -22.125 +0.745 X ₁	0.003	0.40	0.21
Murshidabad	0.411*	0.514**	0.202	0.195	0.236	Y= -3.794 +0.374 X ₂	0.001	0.39	0.24
Malda	0.531**	0.464**	0.100	0.358*	0.405*	Y= -7.599+0.286X ₁	0.001	0.50	0.26
Nadia	0.479**	0.508**	0.282	0.300	0.304	Y= -1.788+0.200X ₂	0.002	0.51	0.23
Natural Enem	ies								
Malda						Y= 3.284 -0.022X ₄	0.007	0.445	0.174
Nadia						Y= 2.906 -0.024X ₄	0.006	0.44	0.175

 X_1 : Max. Temperature, X_2 : Min. Temperature, X_3 : Max. Relative Humidity, X_4 : Min. Relative Humidity and X_5 : Rainfall . *Significant at 5% level;**Significant at 1% level

 Table 41.Seasonal occurrence of major pest population in mulberry ecosystem of Kalimpong and Jorhat (2014- 2017)

Particulars	Kalimpong	Jorhat				
	Root Mealy Bug	Thrips	Whitefly	Mealy bug		
		(Avg. no. per leaf)	(Avg. no. per leaf)	(Avg. no. per shoot)		
Jan	1	0	0	0		
Feb	1	3	0	4		
Mar	1	0	0	0		
Apr	0	4	2	4		
Мау	0	3	6	6		
Jun	2	4	5	5		
Jul	7	3	6	3		
Aug	14	2	8	4		
Sep	12	4	11	4		
Oct	4	2	15	4		
Nov	3	0	13	4		
Dec	2	0	0	0		
Avr.	4.7	2.04	5.5	3.14		
Range	0-14	0-4	0-15	0-6		



Fig. 11. Month -wise incidence of pest & NE in West Bengal







Fig.13. Month-wise incidence of pest & NE in Jorhat

Table 42. Regression	analysis between	infestation of	of major m	nulberry pests	and weather
factors (Jor	rhat)				

Pest	Model	P-value	R	Adj. R ²
Thrips	Y= -0.235 +0.161X ₂	0.029	0.63	0.334
Mealy Bug	Y= 0.026 +0.213X ₂	0.018	0.66	0.386

 Table 43. Biological attributes of the parasitoid, Encarsia spp.

Fecundity (No. of eggs /female)	Incubation period	Longevity of larval instars (No. of Days)	Pupation period (No. of Days)	Adult Longevity (No. of Days)	Multiplication rate	Life cycle duration (No. of Days)
60-110	7-10	9-11	7-10	8-12	45-70	31-43

Conclusion:

From the compiled data it is evident that incidence of pest population is positively correlated with the abiotic factors and natural enemies like predators and parasitoids.

- The highest population of thrips during April is due to favourable maximum temperature of 38°C and rise of minimum temperature from 15°C in March to 20°C in April apart from occasional rainfall of 8 mm to 29.19 mm
- Step-wise regression analysis also shows positive contribution of maximum temperature on incidence of thrips
- Increase of RH and rainfall decreases the population of thrips
- The highest population of white fly was recorded during Oct. when max. temp. was 35°C and min. temp. was 18°C, rainfall 18 mm, min. RH was 49%. Rainfall of 144 mm in Sept. apart from min.temp. of 22°C and min. humidity 54% created favourable atmosphere for enhancing white fly population of the following month i.e. Oct.
- Step-wise regression analysis also supports this view that when the minimum RH increases, the *white fly* population significantly increases.
- Adult whitefly population decreases due to heavy rainfall
- The highest incidence of mealy bug was observed during June when maximum temperature was >38°C and minimum temperature was 23°C
- Step-wise regression analysis shows positive and significant attribution of maximum and minimum temperature on incidence of mealy bug
- Heavy rainfall decreases mealy bug population as it wash away the eggs, adults and other stages of mealy bug.
- Naturally available parasitoids are capable to control the pests

Recommendation: From these informations it is possible to predict the time of invasion of the sucking pests of mulberry and severity of infestation in different districts of eastern and north eastern regions. Accordingly, farmers may be forewarned as it has immense value in taking preventive and control measures so as to keep the pest population level below economic threshold level. Culture of natural enemies and their release in field holds an important role in diminishing the pests at field level.

10.B.I.2.2.PPE 3533: Incidence of whitefly in Mulberry germplasm accessions. (Mar., 2015 to Feb., 2018).

S.Chanda (PI), D.Das, S.Chattopadhyay.

Objectives:

• To observe the incidence of whitefly in the mulberry germplasm for selection of putative sources of resistant and susceptible variety for whitefly infestation.

• To evaluate the selected germplasm for whitefly resistance using physiological and biochemical parameters.

The following experiments were conducted:

Observation on incidence of whitefly in mulberry germplasm accessions for resistant and susceptible varieties:

The experiment was carried out in the Germplasm field of this Institute comprising of 154 varieties of exotic mulberry. From each mulberry variety three mulberry plants were selected to see the incidence of whitefly. The top, middle and bottom leaves of three shoots of a plant was considered for observation of incidence of whitefly. Field screening of mulberry germplasm for resistance to whiteflies was done when natural whitefly populations are high and damage levels are significant so as to distinguish susceptible cultivars.

Evaluation of the selected germplasm for whitefly resistance using physiological and biochemical parameters:

For physiological parameter stomata frequency were observed while Acyl Sugar was estimated as biochemical parameter. All these parameters were observed in selected germplasm accessions [10 no. of accessions each for resistant and susceptible varieties]

Results: Based on three years data on incidence of whiteflies, ten number of mulberry germplasm accessions were sorted out from 154 germplasm varieties for low infestation by white flies and ten number of mulberry germplasm accessions sorted out for high infestation by whiteflies (Table 44). Stomata frequency and Acyl Sugar of the concerned varieties are also mentioned in the Table 45 and 46.

#	Name	Avg. Infestation/ leaf	Stomata frequency /mm ²	Acyl Sugar (Δ A mg-1 fresh leaf)
1.	lchihei	0.19 – 0.78	394	1.190
2.	Rostely	0.17 – 1.50	513	0.913
3.	Kabul	0.33 – 1.50	197	1.183
4.	China Black C	0.16 – 2.00	329	1.003
5.	Moretiana	0.33 – 2.17	276	0.973
6.	Ichinose	0.33 – 2.50	206	1.700
7.	China Black B	0.17 – 2.83	171	1.127
8.	Leimoncina	0.17- 3.00	482	1.003
9.	Sen Matso	0.33 - 6.33	217	1.493
10.	Charitul	0.19 – 0.78	329	1.077

 Table 44. Performance of mulberry germplasm accessions with low infestation by whiteflies

#	Name	Av. Infestation/ leaf	Stomata	Acyl Sugar
			frequency/mm ²	(Δ A mg-1 fresh leaf)
1	Kosen	0.33 - 15.27	934	0.603
2	Kirimoto	0.67 – 114.94	758	0.647
3	Hungarian	0.67 – 112.18	508	0.943
4	Okinowaso	0.83 – 111.52	591	0.490
5	Kairo Akiata	0.50 – 110.43	780	0.613
6	Seijuro	0.33 – 8.33	522	0.907
7	Sujanpur-5	0.17 – 17.51	579	0.823
8	KPG-III	0.33 – 16.83	594	0.717
9	Morus nigra	0.83 - 16.73	780	0.903
10	Tomeiso	0.33 - 6.50	710	0.830

 Table 45. Performance of mulberry germplasm accessions with high infestation by whiteflies

 Table 46. Comparison between two group means of Mulberry Germplasm accessions with low and high infestation by whiteflies on stomata frequency and Acyl sugar

Parameters	Accessions with low	Accessions with high	t statistic	P-value
	infestation of WF	infestation of WF		
Stomata frequency	311.40	675.60	5.19	0.0001
(mm ² fresh leaf)	(171 – 1513)	(508 – 1934)		
Acyl Sugar	1.16	0.747	14.35	0.000
(∆ A mg ⁻¹ fresh leaf)	(0.91 – 11.70)	(0.490 – 10.943)		

It was ascertained that during July to Sept. incidence of whitefly was higher. It was also noted that highest incidence was observed during Aug. in most of the varieties due to favorable temperature [Max. -35°C and Min. 27°C] and humidity [Max.-81% and Min-77%]. Lowest incidence was observed during Nov. which is attributed to lowest temperature – both Max. (24.4°C) and Min. (14.6 °C).

Stomata frequency/mm² of fresh leaves of ten mulberry germplasm accessions with low infestation by whitefly shows that the number of stomata ranges from 171 to 513 while it varied from 508 to 934 in ten mulberry germplasm accessions with high infestation by whiteflies. It corroborates with the findings of Mann *et al.* (2017) that whitefly population and number of stomata per leaf is positively correlated.

Acyl Sugar (Δ A mg-1 fresh leaf) was higher in ten mulberry germplasm accessions with low infestation by whiteflies i.e. 0.913 to 1.49 (Table 45) while it varied from 0.490 to 0.943 (Table 46) in ten mulberry germplasm accessions with high infestation by whiteflies. It agrees with the views of Gentile *et al.* 1968, Goffreda *et al.* (1989), Resende *et al.* (2002), Goncalves (2007) and Dias *et al.* (2016) who pointed out that the glandular trichomes of leaf secrete phytochemicals comprising of glucose and sucrose esters of fatty acids (Acyl sugars) and play an important role in resistance to pests and

this can be utilized for breeding programmes to evolve new commercial varieties with improved levels of pest resistance as this character is inherited in subsequent generations (Maluf *et al.* 1997) and Freitas 1999).

Comparison between two group means of mulberry germplasm accessions with low and high infestation by whiteflies on stomata frequency and Acyl sugar showed that the difference is highly significant (P>0.01). Plant to plant variation in terms of concentration of Acyl sugar is supported by the view of Resende *et al.* (2002). It is also observed from t-value that the value of Acyl sugar is higher than the t-value of stomata frequency. Based on these observations it can be inferred that Acyl sugar content in the mulberry germplasm accessions may be a marker for selection of whitefly resistant variety apart from number of stomata/mm² of fresh leaves of mulberry.

Conclusion: From the compiled data it is evident that incidence of whitefly population varies among the mulberry germplasm. Group mean value of low and high resistant varieties of mulberry germplasm showed that stomata frequency/mm² was less in the resistant varieties of mulberry germplasm and was higher in the mulberry germplasm which were denoted as susceptible. It was also noted that Acyl sugar was higher in the resistant varieties of mulberry germplasm while it was lower in the mulberry germplasm which shows susceptibility towards attack by whiteflies. High level of Acyl sugar is attributed to low level of whitefly as Acyl sugar acts as a repellent. This establishes the fact that number of stomata and Acyl sugar play an important role in defence mechanism in the mulberry germplasm against pests.

Technology developed: Ten varieties of mulberry germplasm – each of resistant and susceptible for whitefly infestation have been sorted out to be used in breeding programme in future.

10. B.I.4. SILKWORM BREEDING & GENETICS SECTION

10. B.I.4. 1. AIB 3547: Development of high temperature and high humidity tolerant bivoltine breeds of silkworm (*Bombyx mori* L.) (July, 2015 to June, 2017).

N. Chandrakanth (**PI-**fr. June, 2016), N. Suresh Kumar (**PI** -upto May, 2016), A. K. Saha (up to Dec., 2015) and A. K. Verma.

- **Objective:** To develop thermo tolerant bivoltine silkworm breeds with genetic plasticity to buffer against the adverse climatic conditions of West Bengal.
- > **Breeding resource material and strategy:** In the 1st phase of the project, 10 bivoltine silkworm breeds were found to be tolerant to high temperature $(35 \pm 1^{\circ}C)$ and high humidity $(85 \pm 5\%)$ conditions. These breeds were selected as breeding resource material for this project. The performance of the selected breeds is presented in the Table 47. Using this 10 silkworm breeds, 12 oval and 30 dumbbell

foundation crosses were prepared. Based on the pupation rate of foundation crosses at $35\pm1^{\circ}$ C and $85\pm5\%$ RH condition, five each of oval and dumbbell foundation crosses were short listed (Table 48). These lines were continued till F₈ generation with exposure to high temperature and high humidity at alternative generations. The survived male and female moths were utilized for preparing the next generation. The newly developed breeds were reared at normal temperature and were also subjected to high temperature and high humidity conditions over two seasons. The performances of the newly developed breeds at normal conditions and at $35\pm1^{\circ}$ C and $85\pm5\%$ RH condition are presented in Table 49 and 50, respectively. Significant differences were found among the rearing traits of the silkworm breeds.

#	Name of the breed	Fecundity	Pupation rate	SCW	SSW	Shell %
1	SK6	496	88.50	1.645	0.305	18.55
2	SK7	536	89.80	1.547	0.302	19.52
3	B.Con.1	587	84.35	1.485	0.280	18.85
4	B.Con.4	565	81.37	1.504	0.279	18.57
5	D6PN	485	87.10	1.464	0.283	19.33
6	SK4C	492	88.30	1.577	0.298	18.87
7	BHR2	524	80.60	1.661	0.309	18.59
8	BHR3	444	81.68	1.598	0.295	18.45
9	ATR29	499	94.80	1.341	0.272	20.3
10	GEN3	452	75.60	1.515	0.305	20.1
	Average	508 (444-587)	85.21(75.6 - 197.8)	1.53 (1.34-11.66)	0.292 (0.27-0.31)	19.11 (18.45-
	-					20.30)

Table 47.Performance of the selected bivoltine silkworm breeds at normal conditions

Table 48.	Short	listed	foundation	crosses	(FCs)
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#	Oval FCs	F ₈ generation	#	Dumbbell FCs	F ₈ generation
1	BHR2 x GEN3	HTH1	1	SK6 x SK7	HTH6
2	BHR2 x BHR3	HTH2	2	B.Con.1 x B.Con.4	HTH7
3	BHR3 x GEN3	HTH3	3	D6PN x B.Con.4	HTH8
4	ATR29 x BHR3	HTH4	4	SK6 x B.Con.4	HTH9
5	GEN3 x ATR29	HTH5	5	SK7 x B.Con.1	HTH10

Table 49. Rearing	performance	of newly e	volved breeds	at normal condition
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#	Breed	Fecundity (No)	ERR (No)	ERR Wt (kg)	Single Cocoon Wt.(g)	Single Shell Wt.(g)	Shell (%)			
Οv	Oval lines									
1	HTH-1	433	8520	11.200	1.302	0.214	16.43			
2	HTH-2	543	9200	12.440	1.463	0.272	18.59			
3	HTH-3	580	9420	13.840	1.512	0.281	18.58			
4	HTH-4	518	9600	11.960	1.315	0.258	19.60			
5	HTH-5	573	9540	13.320	1.472	0.276	18.75			

Du	Dumbbell lines								
1	HTH-6	540	8840	11.360	1.357	0.240	17.68		
2	HTH-7	516	8580	13.000	1.549	0.248	16.01		
3	HTH-8	486	8690	11.120	1.458	0.262	17.96		
4	HTH-9	513	9540	13.160	1.439	0.262	18.20		
5	HTH-10	461	9120	11.840	1.301	0.218	16.75		
Α	verage	516	9105	12.324	1.417	0.253	17.86		
CD	@ 5%	33	301	0.694	0.065	0.017	0.82		
С	V%	9.01	4.62	7.87	6.42	9.13	6.39		

Table 50.	Rearing perform	nce of newly	v evolved	breeds	at 35 ±	: 1°C	and 8	$85 \pm 5\%$	6 RH
	condition								

#	Breed	Fecundity	Pupation rate	Single cocoon wt. (g)	Single shell wt. (g)	Cocoon shell %				
Ova	Oval lines									
1	HTH1	525	50.6	1.256	0.227	18.1				
2	HTH2	505	52.4	1.254	0.225	17.9				
3	HTH3	510	50.7	1.301	0.229	17.6				
4	HTH4	495	50.4	1.265	0.225	17.8				
5	HTH5	500	51.2	1.213	0.218	17.9				
Du	mbbell lines	3								
1	HTH6	515	50.8	1.245	0.209	16.8				
2	HTH7	500	50.2	1.185	0.204	17.2				
3	HTH8	505	51.6	1.205	0.208	17.3				
4	HTH9	500	50.8	1.304	0.228	17.6				
5	HTH10	505	50.2	1.267	0.225	17.8				
	Average	506	50.88	1.249	0.219	17.6				
0	CD@ 5%	19.51	1.53	0.09	0.02	0.88				
	CV%	1.73	1.35	3.13	4.29	2.24				

- Hybrid preparation: After fixation of the desired thermo-tolerant traits, 25 possible combinations of hybrids were prepared.
- ▶ *Hybrid evaluation*: All the 25 new hybrids were screened at high temperature and high humidity conditions along with the bi x bi combinations *viz.*, SK6 × SK7 and B.Con.1 × B.Con.4, as control. Significant differences (p<0.01) were found among the rearing traits of the hybrids both at normal and, high temperature and high humidity conditions. The performances of the new hybrids at $35\pm1^{\circ}$ C and $85\pm5^{\circ}$ RH condition and normal conditions are presented in Table 51 and 52, respectively. The percentage reduction in pupation rate was calculated in treated over control batches for the hybrids. The graphical representation of the percentage reduction in pupation rate is depicted in Fig. 14.

#	Breed	Fec. (No.)	Hatch	ERR (wt.)	Single cocoon	Single	Shell %
			(%)	(kg.)	Wt.(g)	shell Wt.(g)	
1	HTH 1 x HTH 6	495	86	6.133	1.344	0.228	17.45
2	HTH 1 x HTH 7	488	95	5.000	1.570	0.255	16.24
3	HTH 1 x HTH 8	497	96	7.233	1.509	0.264	17.50
4	HTH 1 x HTH 9	512	97	9.000	1.540	0.265	17.21
5	HTH 1 x HTH 10	513	97	8.100	1.516	0.265	17.48
6	HTH 2 x HTH 6	469	92	4.733	1.446	0.270	18.67
7	HTH 2 x HTH 7	510	95	6.200	1.440	0.258	17.92
8	HTH 2 x HTH 8	503	98	8.800	1.503	0.274	18.23
9	HTH 2 x HTH 9	461	96	6.933	1.364	0.253	18.55
10	HTH 2 x HTH 10	516	94	6.867	1.433	0.259	18.07
11	HTH 3 x HTH 6	503	95	9.600	1.415	0.251	17.73
12	HTH 3 x HTH 7	447	94	8.267	1.411	0.262	18.57
13	HTH 3 x HTH 8	462	96	7.733	1.402	0.259	18.47
14	HTH 3 x HTH 9	432	96	11.000	1.515	0.265	17.49
15	HTH 3 x HTH 10	485	97	9.600	1.405	0.233	16.58
16	HTH 4 x HTH 6	417	83	10.400	1.435	0.270	18.82
17	HTH 4 x HTH 7	429	94	9.100	1.515	0.272	17.95
18	HTH 4 x HTH 8	362	93	9.000	1.609	0.287	17.84
19	HTH 4 x HTH 9	461	94	9.250	1.485	0.262	17.64
20	HTH 4 x HTH 10	499	97	5.733	1.550	0.273	17.61
21	HTH 5 x HTH 6	489	89	7.150	1.456	0.252	17.31
22	HTH 5 x HTH 7	498	96	7.967	1.426	0.247	17.32
23	HTH 5 x HTH 8	501	98	8.950	1.433	0.264	18.42
24	HTH 5 x HTH 9	486	96	7.667	1.377	0.255	18.52
25	HTH 5 x HTH 10	491	67	9.150	1.450	0.238	16.41
Control	SK6 x SK7	521	92	7.600	1.272	0.205	16.12
Control	B.Con.1x B.Con	504	94	6.733	1.336	0.235	17.59
4							
Average		479.6	93	7.922	1.450	0.256	17.693
Standard deviation		35.82	6.16	1.547	0.076	0.017	0.728
t statistic		68.28**	77.08**	26.104**	97.491**	78.44**	23.93**

Table 51. Rearing performance of 25 new hybrids at 35 \pm 1°C and 85 \pm 5% RH conditions

** indicates p<0.01

Fable 52. Rearing performance of 2.	5 new hybrids at normal	conditions
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#	Breed	ERR (wt.) (kg.)	Single cocoon Wt.(g)	Single shell Wt.(g)	Shell %
1	HTH 1 x HTH 6	9.333	1.544	0.286	18.52
2	HTH 1 x HTH 7	8.200	1.670	0.293	17.54
3	HTH 1 x HTH 8	10.433	1.609	0.302	18.77
4	HTH 1 x HTH 9	12.200	1.640	0.303	18.48
5	HTH 1 x HTH 10	11.300	1.616	0.303	18.75
6	HTH 2 x HTH 6	4.933	1.546	0.308	19.92
7	HTH 2 x HTH 7	9.400	1.540	0.296	19.22
8	HTH 2 x HTH 8	12.000	1.603	0.312	19.46



Average Standard	deviation	10.728 2.561	1.554 0.073	0.295	19.017 0.698
Control B.Con 1 x B.Con 4		9.933	1.436	0.273	19.01
Control	SK6 x SK7	10.800	1.372	0.243	17.71
25	HTH 5 x HTH 10	12.750	1.550	0.276	17.81
24	HTH 5 x HTH 9	10.867	1.477	0.293	19.84
23	HTH 5 x HTH 8	14.150	1.533	0.302	19.70
22	HTH 5 x HTH 7	11.167	1.526	0.285	18.68
21	HTH 5 x HTH 6	10.350	1.556	0.290	18.64
20	HTH 4 x HTH 10	4.933	1.650	0.311	18.85
19	HTH 4 x HTH 9	10.400	1.585	0.310	19.56
18	HTH 4 x HTH 8	14.200	1.709	0.325	19.02
17	HTH 4 x HTH 7	12.300	1.615	0.310	19.20
16	HTH 4 x HTH 6	12.600	1.535	0.308	20.07
15	HTH 3 x HTH 10	13.800	1.505	0.271	18.01
14	HTH 3 x HTH 9	14.200	1.615	0.303	18.76
13	HTH 3 x HTH 8	4.933	1.502	0.297	19.77
12	HTH 3 x HTH 7	11.467	1.511	0.300	19.85
11	HTH 3 x HTH 6	12.800	1.515	0.289	19.07
10	HTH 2 x HTH 10	10.067	1.533	0.297	19.37
9	HTH 2 x HTH 9	10.133	1.464	0.291	19.88

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** indicates p<0.01



Fig. 14. Graphical representation of percentage reduction in pupation rate of new hybrids in treated over control batches.

Selection of hybrids: After evaluation, promising hybrids with high pupation rate in comparison to the other hybrids and controls viz., SK6 × SK7 (72%) and B.Con.1 × B.Con.4 (65%) were selected. Two hybrids namely HTH3 × HTH6 (77%) and HTH4 × HTH9 (76%) were found to be more tolerant to high temperature and high humidity conditions when compared to other hybrids and their percentage reduction was also less compared to the other hybrids (Table 53).

#	Hybrid	25±1°C & 65±5 %	35±1°C & 85±5 %	Percentage reduction
1	HTH1 x HTH6	74	56	-24.32
2	HTH1 x HTH7	78	63	-19.23
3	HTH1 x HTH8	86	53	-38.37
4	HTH1 x HTH9	85	65	-23.52
5	HTH1 x HTH10	83	65	-21.68
6	HTH2 x HTH6	85	61	-28.23
7	HTH2 x HTH7	90	45	-50.00
8	HTH2 x HTH8	92	60	-34.78
9	HTH2 x HTH9	89	66	-25.84
10	HTH2 x HTH10	87	65	-25.28
11	HTH3 x HTH6	92	77	-16.30
12	HTH3 x HTH7	94	56	-40.42
13	HTH3 x HTH8	92	76	-17.39
14	HTH3 x HTH9	91	75	-17.58
15	HTH3 x HTH10	87	67	-22.98
16	HTH4 x HTH6	90	74	-17.77
17	HTH4 x HTH7	90	59	-34.44
18	HTH4 x HTH8	86	68	-20.93
19	HTH4 x HTH9	91	76	-16.48
20	HTH4 x HTH10	92	65	-29.34
21	HTH5 x HTH6	87	55	-36.78
22	HTH5 x HTH7	86	70	-18.60
23	HTH5 x HTH8	89	68	-23.59
24	HTH5 x HTH9	87	61	-29.88
25	HTH5 x HTH10	91	67	-26.37
Control	SK6 x SK7	88	72	-18.18
Control	B.Con 1 x B.Con 4	87	65	-25.28

 Table 53. Percentage reduction of pupation rate of new hybrids in treated over control batches

Conclusions: Two new hybrids namely HTH3 \times HTH6 and HTH4 \times HTH9 were found to be tolerant to high temperature and high humidity of 35 \pm 1°C & 85 \pm 5 % conditions. They were on par with the controls both in terms of tolerance and productivity merits.

Future plan of work: On farm trails/ out station trails of the identified two new hybrids, HTH3 \times HTH6 and HTH4 \times HTH9 along with the controls, SK6 \times SK7 and B.Con.1 \times B.Con.4 can be conducted.
B.I.4.2. AIB 3514: Development of multivoltine based congenic / NIL breed of silkworm (*Bombyx mori* L.) through introgression of "*Id*" character and its' use. (Aug., 2014 to Jul., 2017).

A.K.Verma (**PI**), G.K.Chattopadhyay (up to 31.10.14), A.K.Saha (upto 05.12.15), N. Suresh Kumar (upto31.05.16) and N.B.Kar.

- **Objective:** Development of Multivoltine (V₃) based congenic/ NIL (Near Isogenic Line) / breed through introgression of target *Id* (Inhibiter of diapause) character.
- Development of multivoltine based Congenic / NIL Breed through introgression of Id character:

Receptor: High survival improved M.Con.4 as multivoltine (V₃) and bivoltine B.Con.4 lines as non-pigmented yellow colour eggs with sex chromosome WZ (2n = 54 A+WZ) as a female and ZZ (2n = 54 A+ZZ)as male and both having maternally controlled non-diapausing trait considers as recipient without "*Id*" gene.

Donor: BHB^{*ld*} pseudo-pigment purple colour eggs breed with chromosomes $2n = 52 \text{ A} + A^{Id}A^{Id} + WZ$ as a female and $2n = 52 \text{ A} + A^{Id}A^{Id} + ZZ$ as male. Only females are considered as a donor having homozygous dominant "*Id* "gene in autosome.

Specific breeding approach and screening methods was followed to develop congenic silkworm, *Bombyx mori* L as mentioned by Chattopadhyay *et al.* (2014). From this method emerged males and females from non pigmented eggs were allowed for sib mating and were considered as "*Id*" gene carrier non pigmented diapause inhibitor breeding lines after confirmation by making cross with pure bivoltine females.

Results: The developed "Id" carrier breeds can be used for making extra lakhs of bi x multi dfls which will bring a boon in Sericulture Industry along with upliftment of poor farmers. Earlier only male of the bivoltine breeds are utilized and females are rejected/destroyed as Acid treatment of such a large number of bi x multi dfls is not possible. This causes a great loss (Table 54).

Five breeds *viz.*, **1. M.Con.4^{Id}** (Pseudo pigmented Diapause Inhibitor Yellow Oval shaped cocoon), **2. M.Con.4**^{Id} (Non pseudo Diapause Inhibitor Yellow Oval shaped cocoon), **3. M.Con.4**^{Id} (Pseudo Pigmented Butter Colour Cocoon), **4. B.Con.4**^{Id} (Pseudo Pigmented Butter Colour Cocoon) and **5. BHB**^{Id} (Pseudo Pigmented White Colour Oval & Dumbbell) with *Id* character has been developed (Table 55 to 56).

Fable 54. Loss due to non-use	of bivoltine female and	l multivoltine male	in the grainage
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Particulars	Amount in Rupees
I. Pure Mysore/female parent	
Requirement of multi x bi laying per year	33 crore
Cocoons required @ 25 % recovery rate (No.)	132 crore
50 % males not used in grainages (No.)	66 crore
Weight of male cocoons (@1000 cc/kg)	660 MT
Value of male cocoons (@ 180/kg)	11.88 crore
Amount recovered from sale of pierced cocoons (@ Rs.180/ 4000 cocoons)	2.97 crore
Net loss	8.91 crore
II. NB4D2/Bivoltine male parent	
Requirement of seed cocoons(No.) (50% of females)	66 crore
50% of females required	33 crore
Weight of female cocoons (@700 cc/kg)	471.43 MT
Value of female cocoons (@ 250/kg)	11.79 crore
Amount recovered from sale of pierced cocoons(@Rs.250/2500 cocoons)	2.95 crore
Net loss	8.84 crore
Grand loss	17.75 crore



Normal Multivoltine Eggs

Pseudo pigmented eggs

Non pseudo pigmented eggs

Fig.15. Egg character

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* *M.Con.* 4^{Id} - a non-pseudo pigmented, diapause inhibitor golden yellow (*C*) colour oval shape non- diapausing breed. ***M.Con.* 4^{Id} - a pseudo pigmented diapause inhibitor butter colour oval shape) non- diapausing breed. *** *M.Con.* 4^{Id} - a pseudo pigmented diapause inhibitor golden yellow (*C*) colour oval non- diapausing breed.

Fig.16. Shape and Size of cocoon

Breeds'	Char. Egg	Cocoon color & Shape	Fec- undity	Hat- ching %	ERR	ERR Wt (kg)	SCW (g)	SSW (g)	Shell%	F.L (m)
M.Con.4	NP	GY (O)	415	97	8067	9.40	1.247	0.209	16.76	665
M.Con.4	SP	Bt (O)	422	94	8300	9.57	1.254	0.218	17.42	615
M.Con.4	SP	GY (O)	428	95	8233	8.97	1.278	0.235	18.37	689
M.Con.4(Check)	NM	GY (O)	463	96	7400	8.87	1.291	0.21	16.27	589
B.Con.4	SP	Bt (O)	447	96	7967	10.27	1.403	0.245	17.46	698
B.Con.4(Check)	DB	W (FD)	523	96	8000	9.83	1.500	0.284	18.93	715
BHB ^{Id}	SP	W (O & D)	393	96	8500	10.93	1.287	0.249	19.35	589

Table 55. Performance of Diapause Inhibitor (Id) Carrier Breeds F₁

NP: Non pigmented; SP: Pseudo pigmented; NM: Normal Multivoltine; DB: Diapausing like Bivoltine; GY: Golden Yellow; Bt:Butter; W: White; O:Oval; D:Dumbbel and FD:Faint Dumbbel

Breeds'	Char.	Cocoon	Fec-	Hat-	ERR	ERR Wt	SCW	SSW	Shell%
Name	⊏yy	& Shape	unuity	%		(kg)	(9)	(9)	
M.Con.4	NP	GY (O)	525	98	9100	11.80	1.288	0.208	16.14
M.Con.4	SP	Bt (O)	485	97	9212	11.58	1.261	0.218	17.29
M.Con.4	SP	GY (O)	542	98	9145	11.08	1.232	0.221	17.94
M.Con.4 (Check)	NM	GY (O)	502	95	9112	11.55	1.301	0.211	16.22
B.Con.4	SP	Bt (O)	572	94	9412	11.41	1.254	0.230	18.34
B.Con.4 (Check)	DB	W (FD)	615	96	8721	12.10	1.368	0.260	19.00
BHB	SP	W (O & D)	445	95	9255	10.25	1.152	0.210	18.22

Table 56. Performance of Diapause Inhibitor (Id) Carrier Breeds (F₂₄)

	Table 5	57. Performance	of Diapause	Inhibitor	(Id)	Carrier	Breeds
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Breeds' Name	Char. Egg	Cocoon color & Shape	Fec- undity	Hat- ching %	ERR	ERR Wt (kg)	SCW (g)	SSW (g)	Shell%	FI. length (m)	FI. size (d)	Reel- ability (%)	Raw silk %	Neat- ness	Even- ness %
M.Con.4	NP	GY (O)	513	95	8900	13.07	1.49	0.261	17.56	554	2.44	80.13	10.16	80	83
M.Con.4	SP	Bt (O)	498	96	8367	13.03	1.57	0.274	17.45	695	2.41	82.22	11.02	82	83
M.Con.4	SP	GY (O)	516	97	8633	11.30	1.32	0.221	16.73	582	2.51	80.05	10.56	80	82
M.Con.4 (Check)	NM	GY (O)	491	97	9210	11.05	1.29	0.215	16.66	459	2.74	78.25	10.24	82	83
B.Con.4	SP	Bt (O)	548	96	8867	11.63	1.21	0.225	18.60	654	2.39	82.22	10.85	84	85
B.Con.4 (Check)	DB	W (FD)	611	97	8733	12.73	1.46	0.273	18.70	805	2.56	87.00	13.3	90	90
BHB	SP	W (O & D	412	97	8600	10.27	1.20	0.214	17.88	824	2.42	88.25	13.00	85	90

The developed breeds reported here, are the inhibitor of diapause and lay pseudopigmented and non-pigmented non-diapausing eggs. Al the "Id" breeds are homozygous dominant Id gene (inhibitor of diapausing) carrier and cocoons are golden yellow (C) color with oval shaped. The other qualitative and quantitative characters of screened M.Con.4^{Id} are mostly better than recipient M.Con.4 (Table 57).

Quantity and quality Assessment after crossing with Bivoltine breed:

Developed "*Id*" breeds have been tested as male parent with the female of ruling & under trial bivoltine FC. The Bi x Multi ^{Id} hybrids are brushed without Acid treatment. The following bivoltine lines or their foundation crosses are used as female. Congenic bivoltine lines can also be reared individually without making FC with same result as FC during unfavourable seasons.

Breeds'	Fec.	Hat %	Yield/ 10000 larvae (No.)	Yield/ 10000 larvae Wt (kg)	SCW (g)	SSW (g)	Shell %	FI. length (m)	FI. size (d)	Reel- ability (%)	Raw silk %	Neat- ness	Even- ness %
BM-1	526	90	9433	13.03	1.385	0.251	18.12	636	2.01	87.24	11.46	88	93
BM-2	580	88	9167	12.67	1.405	0.259	18.43	573	1.92	82.29	10.12	88	93
BM-3	438	92	9067	11.73	1.285	0.232	18.05	472	2.25	84.96	11.14	89	93
BM-4	460	95	9300	12.03	1.314	0.228	17.35	615	2.23	83.61	9.04	88	91
BM-C	412	97	9324	10.98	1.306	0.209	16.00	574	2.75	80.4	10.0	83.5	90

Table 58. Performance of Bi x Multi ^{Id} hybrid without acid treatment (June-July, 2017)

BM-1: (B.Con.4xB.Con.1)x M.Con.4[™]; BM-2: (B.Con.1xB.Con.4)xM.Con.4; BM-3: (SK6xSK7)xM.Con.4; BM-4: (SK7xSK6)x M.Con.4 and BM-C: N x(SK7 x SK6)

From above it is clear that in Bi x $Multi^{Id}$ reciprocal cross, best hatching was observed after 72 hr black boxing. The rearing and reeling performances of these reciprocal crosses are much better than check multi x bi hybrids (Table 58).

The breeds developed as pseudo-pigmented and non-pseudo pigmented (Fig.15 and 16) – a new diapausing inhibitor similar like avoltine (V_0) breed, have no differences in their qualitative and quantitative expression and observed to be better than the recipient congenic M.Con.4. Exceptional behaviour is in egg as a non diapausing pseudo pigmented diapause inhibitor (Rajendra *et al.*, 2010a, b) or non-pseudo diapause inhibitor homozygous dominant autosome linked *Id* character carrier breed like avoltine (V_0). The male of these breeds when crossed with female of different diapausing breeds / strains or its' reciprocal eggs are non diapausing and hatch normally without acid treatment. It suggests that autosome linked homozygous dominant *Id* (inhibitor of diapause) character alter the well-established obligatory phenomenon of maternal inheritance related with diapause as here bivoltine (V_2) females lay non-diapausing eggs in F_1 after crossing with *Id* character carrier developed breed and segregation appear in F_2 generation instead of F_3 as an exception of maternal law of inheritance. So this finding also support that the gene contributed by male supersedes the gene action of

different diapause related genes contributed by the mother (Rajendra *et al.*, 2004, 2010 a, b). The egg character of developed M.Con.4^{Id} as a pseudo and specially non-pseudo pigmented a new finding as can be used as inhibitor of diapause. It has been observed that male of *Id* character carrier breed when crossed with female of normal diapausing breeds no need of acid treatment as normally 96 - 99 % hatching occur in F₁. Especially the genetic basis for appearance of non - pigmented egg after introgression of "*Id*" character the inhibitor of diapause and possessor of pigmented egg is not clear. To understand the bio-chemical nature of this breed, the work is in progress to estimate level of esterase concentration, hibernations potency value, etc.

Conclusion: The developed breeds with "*Id*" character will be used in the grainage to produce bi x multi^{Id} (reciprocal cross) dfls commercially. At present, bivoltine female and multivoltine males are discarded which incur a great loss. A few years back it is estimated about 17 crores in a year in southern India. This is due to the problem of Acid treatment for bi x multi dfls which is not possible in a large scale. This bi x multi^{Id} hybrid does not require acid treatment. This will be a great help to the sericulture industry.

Future Plan of work: Large scale trial of bix multi^{ld} (reciprocal cross) hybrids will be undertaken in the field.

 B.I.4. AIB 3545: Authorization Trial of Silkworm hybrids in Eastern and North Eastern India. (Aug., 2015 to March, 2018). [Collab. with NSSO, Bangalore and CSTRI, Bangalore]

> A.K.Verma (**PI**), N. Suresh Kumar, A. K. Saha, CSR&TI, Berhampore; Y.Debaraj, RSRS, Jorhat; N.R.Rao, RSRS, Koraput; G.B.Singh, REC, Agartala; B. Choudhary, REC, Aizawal; Collin, REC, Shillong; D.P. Das Mahapatra, REC, Deogargh; G.S. Singh, REC, Bhandra; R. Kumar, REC,Gumla;. A. Dutta, REC, Mothabari; T Dutta Biswas, REC, Kamnagar; D.Pandit, REC, Maheshpur Raj; S. Singh, REC, Imphal; S.T.Lepcha REC, Rangpo.

Objectives: The main objective of the project is to test the hybrids with the farmers of Eastern and North-Eastern India for its authorization.

The newly developed promising hybrids of CSRTI, Berhampore were considered as hybrid materials for the study. The bivoltine hybrid., B.Con.1 x B.Con.4 with SK6 x SK7 as control and the multi x bi hybrid, M6DPC x (SK6 x SK7) with Nistari x (SK6 x SK7) as control were tested with the farmers of West Bengal, Jharkhand, Odisha, Chattisgargh, Manipur, Assam, Meghalaya, Mizoram, Nagaland and Sikkim for two years seven months covering all the commercial crops of the respective states.

Results: Considering over all the findings of different states for bi x bi and multi x bi hybrids, it was observed that the **B.Con.1x B.Con.4** and **M6DPCx** (**SK6xSK7**) had shown an enhanced production of 7.76% and 8.99%, respectively against their control **N x** (**SK6 x SK7**) (Table 59).

Table 59. Consolidated data on testing of B. Con. 1 x B. Con. 4 and M6DPC x (SK6 x SK7) for considering them towards their authorization (Including both Phase-I and Phase II)

#	Location	B.Con.1	x B.Con.4	SK6	xSK7	M6[(SK6)PCx xSK7)	N x (SK	6 x SK7)
		dfls	Cocoon (kg/100 dfls)	dfls	Cocoons (kg/100 dfls)	dfls	Cocoons (kg/100 dfls)	dfls	Cocoons (kg/100 dfls
1	West Bengal	45600	56.92* (5.54%)	16600	53.93	191000	47.96** (8.09%)	93650	44.37
2	Odisha	10100	41.61 (3.05%)	2700	40.38		No multi x	bi rearing	
3	Jharkhand	8200	53.54* (5.45%)	3000	50.77	12750	41.93		
4	North-East region	97600	47.26* (10.37%)	39200	42.82		No multi x	bi rearing	
(Grand Total	161500	50.68* (7.76%)	62000	46.97	203750	47.03** (8.99%)	101200	43.15
CD (5%) – 3.31⁺						С	D (1%) – 2.3	9**	

Figure in parenthesis denotes gain % over control

Table 60. Reeling Character

Name	Season	Fl. Length (m)	FI. size (d)	Reelability (%)	Raw Silk	Neatness
B.Con.1xB.Con.4	Autumn (Oct Nov.)	780 - 832	2.69	87.0	13.30	88.72
	Spring (Feb-March)	790- 865	2.52	88.24	13.65	90.0
SK6 x SK7	Autumn (Oct Nov.)	700 -750	2.71	85.1	12.8	86.0
	Spring (Feb-March)	748 - 800	2.81	85.4	13.0	86.5
M6DPC x (SK6x	Autumn (Oct Nov.)	665	2.85	82.3	12.85	88.0
SK7)	Spring (Feb-March)	702	2.48	86.3	12.90	86.0
Nx(SK6x SK7) -	Autumn (Oct Nov.)	550	2.75	80.4	10.5	80.5
Check	Spring (Feb-March)	600	2.88	82.2	10.9	84.0

A cocoon sample of all the hybrids under the trail were purchased from farmers after completion of each crop and it was subjected for reeling analysis by the private reeler by out-sourcing. The data was analyzed by SCTH Malda. The average performance of all the crops is given in Table 60.

Grainage performance of test hybrids: The grainage performance the test hybrids at various SSPCs of NSSO are given in Table 61.

SSPC	Actual	cocoons p	rocured	Pairs	dfls	Pairs %	dfls %	Egg	yield
	By No.	By wt.	Cocoon pei kg (No.)					Total (g)	Per kg cocoon(g)
B.Con.1 x B	.Con.4								
Malavalli	521200	783.76	665	200140	178250	38.4	34.2	45630	58.22
SK6 x SK7									
K.R.Nagar	492254	715.48	688	199953	189025	40.62	38.4	42257	61.42
M6DPC x (S	SK6 x SK7)								
Ramn'gar	352795	405.53	870	128850	96200	36.52	27.3	30482	75.17
Nx(SK6 x	SK7)								
Hindupur	586233	627.80	934	225650	208450	38.49	35.6	45213	72.02

Table 61. Grainage performance of test hybrids

Eastern India, especially the state of West Bengal experiences extreme variation in temperature, relative humidity and rainfall. According to climatic conditions, the commercial seasons are broadly divided into two, favourable and unfavourable. The former falls between October to March, when the climatic conditions are congenial for silkworm rearing. Autumn (Nov.) and Spring (Feb.) crops come during this period. April (Baisakhi), commercial crop is also considered as partially congenial for silkworm rearing in terms of prevalence of low humidity. On the other hand, the unfavourable period with prevailing high temperature and humidity conditions starting from May to September are not conducible for silkworm rearing of June-July (Shravani) and Aug.-Sept. (Badhuri & Aswina) crops. Because of high temperature and humidity as well as rainfall, most of the rearers are compelled rear indigenous breed, Nistari, which is very low productive with poor quality. But suitable multi x bi hybrid can successfully be reared during autumn and spring seasons of the plains, which could increase the silk production. The present study has corroborated the idea that new hybrids other than Nistari based hybrids can successfully be reared in West Bengal and similarly new bivoltine hybrids in North –Eastern states and during favourable seasons in West Bengal can also be reared successfully.

Conclusion: Based on the overall performance at farmers field, during favourable seasons (Agrahayani, Falguni and Baishaki) it is recommended to rear the multivoltine hybrids, M6DPC x (SK6 x SK7) in West Bengal and Jharkand states. With regard to bivoltine hybrids, it was recommended to rear B.Con.1 x B.Con.4 in West Bengal, Jharkand North Eastern states. *Both the hybrids have been authorized by HAC of Central Silk Board on 19.02.2018.*

Future Plan of work: Both the hybrids will be utilized in the field as ruling hybrids.

10.B.I.5. AGRONOMY & SOIL SCIENCE SECTION

11.C.III. 1. PPS 3559: Testing of carbon capturing potential of mulberry in different locations. (April, 2015 to March, 2018).

R. Kar (**PI** –fr.13.07.2016 at RSRS, Kalimpong), S.K.Misro (**PI** at RSRS, Koraput) and S.N.Gogoi (**PI** at RSRS, Jorhat).

D. Chakravarty (**Coordinator-**fr. Jan., 2018) & Monica Choudhary (**Coordinator-**upto Dec., 2017)

Objectives:

- Assessment of carbon capturing potential of mulberry in varying ecogeographic conditions.
- To examine the validity of the technology for spraying of cationic micronutrients in mulberry garden at farmers level.

The field experimentation had been executed at farm level of each of the four units, namely, Kalimpong, Koraput, Ranchi and Jorhat. Each farm spared a land of 0.1 bigha (0.033 acre) each for existing farming practice and altered farming practice. Once deep digging and rest shallow (single surface) diggings along with grass cover had been considered under altered farming practice followed by incorporation of the grass cover with the soil. Under existing farming practice, all the diggings were deep and there was regular weeding, but no incorporation of grass with soil. Crop wise recording of leaf productivity and collection of leaf samples for estimation of carbon. Recording of shoot productivity and collection of shoot samples for estimation of carbon matching with the pruning schedule. Estimation of moisture% of leaf and shoot samples (at 70° C). Ignition of oven-dried (at 70° C) leaf and shoot samples at 550°C for 6 h in a muffle furnace to determine the carbon content (Nath and Das, 2011).

Results: Carbon sequestration depends upon biomass production capacity, which, in turn, depends upon interaction between edaphic, climate and topographic factors of an area. Hence results obtained at one place may not be applicable to another. Therefore, region-based potential of different land uses needs to be worked out.

Development of high yielding mulberry varieties is the basic need of sericulture industry for enhancing the rearing capacity of silkworm. Besides higher productivity, the high yielding mulberry varieties are providing huge biomass for carbon mitigation by photosynthetic capture and thus, prove to be an effective agent for offsetting carbon emissions. But, evaluation of those mulberry varieties in terms of carbon sequestration potential in varying conditions has not been paid serious attention hitherto. Considering the current agenda of Global Warming, it was proposed to assess carbon capturing potential of mulberry growing in different regions and for that purpose, the altered farming practice as 'moderate tillage with grass cover' diagnosed competent so far, had been tried at regional level. The diagnosed altered farming practice had been tested against existing farming practices (intensive tillage without grass cover) of different regions for comparison.

In view of the above, information pertaining to productivity and CCP of mulberry grown under existing (intensive tillage without grass cover) as well as altered farming practice (moderate tillage with grass cover) in different test centers have been generated and furnished from Table 62 to 65.

Season	Sample	Leaf/ shoot	/ield (kg ha ⁻¹)	Carbon capturing	potential (kg ha ⁻¹)
		Altered farming practice	Existing farming practice	Altered farming practice	Existing farming practice
August, 2015	Leaf	6320	5880	792	669
December, 2015	Shoot	6075	5850	941	847
April, 2016	Leaf	5760	5020	653	554
June, 2016	Shoot	6480	5980	920	820
August, 2016	Leaf	5840	5320	710	609
December, 2016	Shoot	6030	5760	886	813
April, 2017	Leaf	5880	5440	678	608
June, 2017	Shoot	6130	5870	869	794
December, 2017	Shoot	5980	5700	873	804

Table 62.	Yield and carbon capturing potential of mulberry growing under two dif	fferent
	farming practices at Kalimpong, West Bengal	

Mulberry growing in Eastern Himalayas, per-humid eco-region with brown and red hill soils of Kalimpong (Table 62) registered significant effect of alteration of farming practice on CCP [t-stat (leaf) 2.565*; t-stat (shoot) 4.932^{**}]. Compilation of data revealed that mulberry growing under moderate tillage with grass cover (altered farming practice) can capture an average of 3.21 t carbon annually from one hectare of land while mulberry growing under existing farming practice (intensive tillage without grass cover) can capture 2.85 t carbon annually from the same area of land. Thus, the former registered an annual carbon credit of 0.36 t ha⁻¹ over the existing farming practice.

Table 63 furnishes below data pertaining to CCP of mulberry growing in Eastern Ghat, hot sub-humid eco-region with red and laterite soils of Koraput and the same exhibited that altered farming practice had an edge over existing farming practice in terms of CCP (t-stat NS). Compilation of data revealed that mulberry growing under moderate tillage with grass cover (altered farming practice) can capture an average of 2.31 t carbon annually from one hectare of land while mulberry growing under existing farming practice (intensive tillage without grass cover) can capture 2.10 t carbon annually from same area of land. Thus, the former registered an annual carbon credit of 0.21 t ha⁻¹ over the existing farming practice.

Season	Sample	Leaf/ shoot y	ield (kg ha-1)	Carbon capturing	potential (kg ha-1)
		Altered farming	Existing farming	Altered farming	Existing farming
		practice	practice	practice	practice
August, 2015	Leaf	4315	4231	484	453
October, 2015	Leaf	3571	3492	500	471
December, 2015	Shoot	1357	1295	201	183
March, 2016	Leaf	2580	2450	310	282
June, 2016	Shoot	4617	4444	647	597
August, 2016	Leaf	4346	4229	465	434
October, 2016	Leaf	3622	3486	431	398
December, 2016	Shoot	4069	3812	537	497
March, 2017	Leaf	2641	2053	285	255
June, 2017	Shoot	4593	4469	652	603
August, 2017	Leaf	4596	4317	516	449
October, 2017	Leaf	3638	3497	495	448
December, 2017	Shoot	3960	3570	552	466
March, 2018	Leaf	2366	2290	323	299

Table 63.	Yield and carbon capturing potential of mulberry growing under two different	ent
	farming practices at Koraput, Odisha	

Table 64. Yield and carbon capturing potential of mulberry growing under two different farming practices at Ranchi

Season	Sample	Leaf/ shoot y	ield (kg ha ⁻¹)	Carbon capturing	potential (kg ha ⁻¹)
		Altered farming	Existing	Altered farming	Existing
		practice	farming	practice	farming
			practice		practice
August, 2015	Leaf	4582	4452	516	484
October, 2015	Leaf	4231	4014	552	495
December, 2015	Shoot	2061	1986	304	278
March, 2016	Leaf	3198	3127	430	404
June, 2016	Shoot	4725	4684	626	610
August, 2016	Leaf	4673	4547	541	515
October, 2016	Leaf	4530	4359	538	499
December, 2016	Shoot	2141	2215	274	277
March, 2017	Leaf	3045	2985	416	396
June, 2017	Shoot	4796	4695	652	613
August, 2017	Leaf	4693	4541	559	517
October, 2017	Leaf	4538	4370	528	475
December, 2017	Shoot	2246	2154	302	271
March, 2018	Leaf	3074	2992	374	345

Mulberry growing in Eastern (Chhotanagpur) Plateau, hot sub-humid eco-region with red and laterite soils of Ranchi (Table 64) exhibited similar trend as that of Koraput.

Compilation of data revealed that mulberry growing under moderate tillage with grass cover (altered farming practice) can capture an average of 2.35 t carbon annually from one hectare of land while mulberry growing under existing farming practice (intensive tillage without grass cover) can capture 2.20 t carbon annually from same area of land. Thus, the former registered an annual carbon credit of 0.15 t ha⁻¹ over the existing farming practice.

The non significant effect of altered farming practice over existing farming practice in terms of CCP in Koraput and Ranchi might be due to poor growth of grasses (weeds) under red and laterite soils receiving comparatively lesser precipitation, incorporation of which with soil imparted lesser effect in improving the ambience of soil in terms of organics.

Season	Sample	Leaf/ shoot y	vield (kg ha ⁻¹)	Carbon capturing	potential (kg ha-1)
		Altered farming	Existing farming	Altered farming	Existing farming
		practice	practice	practice	practice
October, 2015	Leaf	4390	4200	579	513
December, 2015	Shoot	2160	1840	337	275
April, 2016	Leaf	5886	5600	647	587
June, 2016	Shoot	4865	4596	750	676
June, 2016	Leaf	5943	5657	663	580
October, 2016	Leaf	5675	5429	672	580
December, 2016	Shoot	4880	4641	721	650
April, 2017	Leaf	5257	5114	599	545
June, 2017	Shoot	4665	4525	683	650
June, 2017	Leaf	5268	5115	577	560
October, 2017	Leaf	4829	4629	565	511
December, 2017	Shoot	4480	4281	695	626

 Table 65. Yield and carbon capturing potential of mulberry growing under two different farming practices at Jorhat

On the other hand, mulberry growing in Assam plain, hot sub-humid eco-region with alluvium derived soils of Jorhat (Table 65) registered significant effect of alteration of farming practice on CCP of leaf [t-stat (leaf) 2.927*], but not on shoot [t-stat (shoot) NS]. Compilation of data revealed that mulberry growing under moderate tillage with grass cover (altered farming practice) can capture an average of 3.12 t carbon annually from one hectare of land while mulberry growing under existing farming practice (intensive tillage without grass cover) can capture 2.81 t carbon annually from same area of land. Thus, the former registered an annual carbon credit of 0.31 t ha⁻¹ over the existing farming practice.

Conclusion: As per assigned target of the study, carbon capturing potential of mulberry growing under varying eco-geographic conditions as discussed above, has been assessed. Information has also been generated on carbon credit due to alteration of

farming practice in mulberry growing under different eco-geographic conditions. The order of annual carbon credit (t ha⁻¹) in different locations is as Kalimpong (0.36) > Jorhat (0.31) > Koraput (0.21) > Ranchi (0.15).

The altered farming practice, "moderate tillage with grass cover" promises to enhance carbon capturing potential of mulberry substantially on long term basis through continuous improvement of soil organic ambience. The protocol is efficient enough to achieve the target of offsetting carbon emission from the atmosphere at an enhanced rate and to store the same subsequently in terrestrial system for further use. The approach matches the current Global agenda for terrestrial sequestration of carbon and promises to act as an agent to save the Globe from warming.

10.B.I.6. SILKWORM PHYSIOLOGY & RTI SECTION

10.B.I.6.1. PPA 3499: Evaluation of field level performance of Vishala mulberry variety in different locations under irrigated conditions in West Bengal (Apr., 2013 to Mar., 2018).

G. C. Das (**PI** from 01.04.2015), S. K. Mandal (**PI** upto 31.03.2015), S. Rajaram (upto 01.12.15), M. S. Rahman (upto 30.09.2014) and in-charges of RECs, DoT (S) and NSSO.

Objectives:

- To find out the potentiality of Vishala mulberry variety under irrigated conditions in West Bengal.
- Evaluation of field performance of Vishala mulberry variety in different locations under irrigated conditions in West Bengal.

Five months old saplings (raised at CSR&TI, Berhampore) of Vishala mulberry variety along with Check variety S1635 were planted in 23 location of 5 districts of West Bengal with 60cm x 60cm spacing. Saplings of test genotypes (Vishala) along with checks (S1635) have been established with 500 plants/ location for each genotype.

	District	Plantation during 1 st year (Dec., 2013)	Plantation during 2 nd year (Dec., 2014)	District wise Plantation	
1.	Nadia	2	5	7	
2.	Murshidabad	3 +1 (Institute)	4	8	
3.	Birbhum	1	1	2	
4.	Malda	1	1	2	
5.	Uttar Dinajpur	4	-	4	
	Total	11 + 1 (Institute)	11	23	

Table 66. District wise plantation in the farmers' field of different location

Transplantation of saplings in 23 locations was completed during Nov. –Dec., 2013 in 12 locations and Nov. -December 2014 in the 11 locations (Table 66). The plantation was maintained through intercultural operations and application of recommended inorganic fertilizer dozes of N, P_2O_5 and K_2O at 360 kg ha⁻¹,180 kg ha⁻¹ and 112 kg ha⁻¹yr⁻¹ in five split doses and FYM 20 t ha⁻¹ yr⁻¹ in two split doses for irrigated gardens.

The genotype Vishala showed survival percentage (96.70 %) at par with the control S-1635 (96.49%). After establishment of one year, the varieties were pruned and evaluated for leaf characters, growth traits and leaf yield along with yield attributing characters.

Results: The growth of silkworm (*Bombyx mori* L.) and production of quality cocoons depends on timely feeding of good quality mulberry leaves to silkworm. Therefore, it is most imperative to analyze different leaf quality traits such as leaf moisture content (LMC), moisture retention capacity (MRC), total chlorophyll, nitrogen, protein, amino acids and carbohydrate contents. The leaf quality traits estimated in mulberry variety Vishala and control (S1635) and presented in the Table 67. LMC and MRC are two important factors in maintaining the nutrition level in mulberry leaves, which in turn improve its palatability for silkworm. These two traits are influenced by genetic and environmental factors (Vijayan *et al.*, 1997) and are also positively related with an increased growth of silkworm larvae (Paul *etal.*, 1992). In the present study, the test genotype Vishala exhibited low Inter-nodal distance (5.26 cm), higher number of leaves per unit length of shoot (22.7/m), 100 leaf weight (655.6 g) & Leaf yield/ plant (574.1 g) higher than check. LMC and MRC were observed 75.3% & 89.5% respectively in Vishala and were on par with control S1635 (74.6% and 90.6%).

Genotype	NS	TSL	LLS	IND	NN/	100 LW	LMC	MRC	LY /P	LA	CC
		(cm)	(cm)	(cm)	m	(g)	(%)	%	(g)	cm ²	(µg/mm²)
Vishala	10.0	804.4	133.3	5.26	22.7	655.6	75.3	90.06	574.1	294.9	15.9
S1635	10.7	845.7	138.0	6.39	21.8	598.0	74.6	90.48	560.0	274.9	16.1
p value of	0.44	0.51	0.89	0.21	0.59	0.35	0.49	0.37	0.91	0.53	0.81
t- statistic											

Table 67. Evaluation of mulberry genotypes through yield and its attributing traits

NS- No. of Shoots; TSL- Total Shoot Length; LLS- Length of the longest shoot; IND- Inter –nodal distance; NN- No. Of nodes; LW- leaf weight; LMC- Leaf Moisture Content; MRC- Moisture Retention capacity; LY /P- Leaf Yield /plant; LA- Leaf Area; CC- Chlorophyll content.

Table 68. Season wise leaf yield potential of Vishala mulberry variety over controlS-1635 at farmers' field

Genotypes	Seasonal leaf yield (kg ha-1)							
	FebMar.	AprMay	JunJuly	AugSept.	OctNov.	(kg ha ⁻¹)		
Vishala	5437.0	8414.4	10379.8	12316.4	8922.3	45469.9		
S-1635	5115.4	7783.8	9352.9	10577.6	8140.8	40970.5		
Improvement %	6.29	8.10	10.97	16.44	9.60	10.98		

	Year wise leaf yield (kg.ha ⁻¹)										
Genotypes	Year-1	Year-1 Year-2 Year-3 Mean of 3 years									
Vishala	35914.8	43939.7	56555.2	45469.9							
S-1635	33125.1	39718.6	50067.8	40970.5							
SEm±	307.5	645.5	1281.6	451.6							
CD at 5%	885.5	1859.1	3690.0	1300.8							

Table 69. Annual leaf yield potential of Vishala mulberry variety over control S-1635

Table	70. Location	effect	on	leaf	yield	potential	of	mulberry	variety	in	different
	Districts of	of West	Be	ngal							

Location	Location wise leaf yield potential (kg/crop/ha)							
	Year-1	Year-2	Year-3	Mean of 3 years				
Birbhum	6712.35	7496.40	10774.64	8327.80				
Nadia	7066.47	8310.30	11613.00	8996.59				
Malda	6937.20	7940.98	10526.45	8468.21				
Murshidabad	7127.90	8166.10	11207.35	8833.78				
U. Dinajpur	6649.48	7114.85	9189.93	7651.42				
SEm±	97.24	104.14	405.28	162.24				
CD at 5%	280.03	309.09	1167.14	405.04				

The mulberry variety 'Vishala' exhibited maximum leaf yield potential (range: 5437.0 to 12316.4 kg ha⁻¹ crop⁻¹) than control S1635 potential (range: 5115.4 to 10577.6 kg ha⁻¹ crop⁻¹). The annual leaf yield recorded 10.98 % higher yield in Vishala (45469.9 kg ha⁻¹ yr⁻¹) than S1635 (40970.5 kg ha⁻¹ yr⁻¹) (Table 68 & 69). The yield potential of Nadia & Murshidabad district is more than other 3 districts (Birbhum, Malda & Uttar Dinajpur) (Table 70).

Rearing performances of silkworm hybrid [N x (SK6 x SK7)] fed on Vishala mulberry variety to assess the leaf quality over its control S-1635 in different seasons at farmers' field. The average yield potentiality is summarized in Table 71. In general, no significant differences were observed in rearing parameters between Vishala & S1635 fed silkworm rearing over its control S1635. But locational effect observed (Table 72) that the yield potential of Malda, Murshidabad & Nadia is higher than Birbhum & Uttar Dinajpur.

Table 71. Potentiality	y of Vishala mulberr	y variety on	cocoon	production	(kg/	100dfls)
at farmers	' field of West Benga	l over S-163	5 variety	7		

	Year wise cocoon yield (kg/ 100 dfls) :Hybrids N x (SK6 x SK7)								
Mulberry variety	Year-1	Year-2	Year-3	Mean of 3 years					
Vishala fed	39.7	37.19	40.78	39.22					
S-1635 fed	40.2	36.93	40.48	39.20					
SEm±	0.309	0.219	0.48	0.34					
CD at 5%	NA	NA	NA	NA					

Location		Location wise coo	oon yield (kg/100 df	ls)
	Year-1	Year-2	Year-3	Mean of 3 years
Birbhum	38.60	34.86	37.81	37.09
Nadia	41.78	37.45	41.15	40.13
Malda	39.50	38.00	43.05	40.18
Murshidabad	41.20	38.38	42.68	40.75
U. Dinajpur	37.70	36.64	38.46	37.60
SEm±	0.47	0.34	0.76	0.52
CD at 5%	1.33	1.01	2.23	1.52

 Table 72. Location effect on cocoon yield potentiality at farmer's field of West Bengal [Hybrids: N x (SK6 x SK7)]

The bioassay study conducted at CSRTI, Berhampore silkworm hybrid (SK6 x SK7/ B.Con.1 x B.Con.4) in different seasons to analyze the influence of varietal leaf quality on silkworm growth and cocoon characters. The average of three seasons (unfavorable season) rearing data recorded on silkworm growth and cocoon characters are summarized in Table 73 and found no significant difference. The average rearing performance of two seasons (favorable season) rearing presented in Table 74. In general, no significant differences were observed on yield parameters between Vishala & S1635 fed silkworm rearing during favourable Season ERR no & Shell ratio.

 Table 73. Rearing Performance during unfavourable Seasons (Apr.- Sept.)

Mulberry	Silkworm	Larval	Wt. of 10	ER	R	SCW	SSW	SR%
Genotype	Hybrids	duration	mature Iarvae	No.	wt. (kg)	(g)	(g)	
Vishala fed	SK6 x SK7	24	34.73	8771.3	11.377	1.347	0.246	18.284
S1635 fed	Do	24	34.87	8807.7	11.413	1.351	0.247	18.312
p value	of t stat	1.00	0.765	0.270	0.700	0.621	0.698	0.874

Table 74. Rearing Performance during favourable Seasons (Oct. to Feb.)

Mulberry Silkworm		Larval	Wt. of 10	ERF	ł	SCW	SSW	SR%
Genotype	Hybrids	duration	mature Iarvae	No.	wt. (kg)	(g)	(g)	
Vishala fed	B.Con.1 x	26.6	37.47	9386	12.743	1.409	0.277	19.661
	B. Con. 4							
S1635 fed	Do	26.9	37.51	9484	12.879	1.418	0.279	19.686
p value	of t stat	0.315	0.911	0.006**	0.116	0.521	0.548	0.008**

Mulberry leaf quality assessment through feed conversion efficiency: The bioassay conducted at CSRTI, Berhampore through feed conversion efficiency during Jun. –July, 2016 with B.Con.1x B.Con.4. Vishala mulberry variety was evaluated in respect of

nutrition status through feed conversion efficiency over S1635 mulberry variety. The growth and development of silkworm larvae and economical characteristics of cocoon is influenced largely by quality leaves of mulberry. Higher nutritional efficiency conversion of ingesta to cocoon and shell were presented in the Table 75.

Particulars	Vishala	S1635	p value of t statistic
Ingesta	6.42	6.82	0.85
Digesta	3.19	3.60	0.77
AD%	49.65	52.73	0.80
ECI to larvae %	10.93	9.41	0.52
ECD to larvae %	22.02	17.85	0.61
ECI cocoon	8.98	8.39	0.79
ECD cocoon	18.10	15.91	0.80
ECI shell	4.04	3.43	0.36
ECD shell	6.42	6.82	0.85
l/g cocoon	3.19	3.60	0.77
D/g cocoon	49.65	52.73	0.80
l/g shell	10.93	9.41	0.52
D/g shell	22.02	17.85	0.61
Avg SW	8.98	8.39	0.79
Avg CW	18.10	15.91	0.80
SR%	4.04	3.43	0.36

 Table 75. Assessment of mulberry leaf quality of Vishala & S-1635 variety through feed conversion efficiency

Efficiency conversion of Ingesta and Digesta to cocoon shell; the efficiency of conversion to cocoon was shown higher in Vishala (8.98) than S1635 (8.39) and efficiency conversion of Digesta to cocoon was higher in Vishala (18.10) than S1635 (15.91). The higher shell weight was found in feed with Vishala (0.26) mulberry leaves than S1635 (0.24). The average cocoon weight is found 0.57 in both cases. The higher SR% is found in Vishala (45.24) and lower SR% was recorded in S-1635 (42.10). Hence, it can be concluded that the Vishala is qualitatively superior/ on par with S-1635.

Table 76. Percentage of Disease index	(PDI) of foliar	disease & pest of	mulberry.
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Particulars	Vishala	S-1635	p value of t stat
MLS	5.90	8.27	0.02
BLS	8.53	10.47	0.04
РМ	7.63	8.13	0.61
Tukra (no./ Plant	12.00	11.67	0.86
White fly (no./ leaf)	9.67	12.33	0.10
Thrips	9.33	8.33	0.47

*<0.05; MLS-Myrothecium leaf spot; BLS-Bacterial leaf spot; PM- Powdery Mildew

Pest incidence (Thrips & Mealy bugs) was maximum during Feb –May crop in all districts (8-12/ leaf) whereas white fly population was maximum during July to September crop (8-14/ leaf). Incidence of leaf spot (BLS & MLS) foliar disease prevailed during June –August and significantly higher in check (S-1635) over test variety (Vishala) mulberry variety (Table 76).

Conclusion: The overall performance of Vishala test genotype showed 10.98% higher leaf yield potential (45.479 t. ha⁻¹year⁻¹) over check mulberry variety S-1635 (40.971 t. ha⁻¹year⁻¹) in the irrigated condition of West Bengal. The mean percentage of disease index (PDI) of foliar disease observed higher



severity in check variety (S-1635) over test genotype Vishala. In respect of leaf quality both the variety are good enough and on par for rearing of Silkworm & production of cocoons and its quality.

10.B.I.6.2. AIT: 3557: Multi locational trial on Transgenic BmNPV resistant silkworm strains to establish their efficacy and generate data for their regulatory approval (Jan., 2016 to Aug., 2017). [Collab. with CDFD, Hyderabad and APSSRDI, Hindupur]

G.C. Das (**PI**), Jayeeta Sarkar (upto 28.02.2017) and S. Roy Chowdhury (upto 23.07.2016).

Objective: To conduct multilocational trials in contained facilities on GE BmNPV resistant *Bombyx mori* to establish their efficacy and generate data on parameters determining the resistance of transgenic lines against NPV for further steps in regulatory process.

Transgenic silkworm hybrids rearing were conducted at Institute level of two experimental site of West Bengal. Total nine trials were conducted under CSR&TI, Berhampore, West Bengal and its nested unit. Out of which five trails conducted at CSR&TI, Berhampore, Murshidabad and four trials conducted at the experimental site of REC, Mothabari, Malda during 2016 -18. As per the conditions stipulated by RCGM, all Trials conducted following the standard operating procedures (SOPs).

Table	77.	Pooled	mean	value	of	rearing	performance	conducted	at	CSR&TI,
		Berham	pore							

Hybrid	Fec.	ERR wt	SCW (g)	SSW (g)	Shell %	FL	NBFL	Denier	Raw silk	Reco-
		(kg)							%	very %
Transgenic	324.9	10.89	1.450	0.2229	15.38	575.3	510	2.44	9.75	79.07
Non-Transgenic	345.6	11.95	1.543	0.2322	15.06	554.7	486	2.39	9.54	77.86
t statistic	13.2*	NS	NS	NS	NS	NS	NS	NS	NS	NS
% improvement	-5.99	-8.87	-6.03	-4.01	2.12	3.71	4.94	2.09	2.20	1.55

Hybrid	Fec.	ERR	SCW	SSW	Shell	FL	NBFL	Denier	Raw	Reco-
		wt (kg)	(g)	(g)	%				silk %	very %
Transgenic	313.7	7.2	1.40	0.20	14.10	584.9	528.9	2.50	9.6	78.66
Non-Transgenic	318.0	7.6	1.40	0.20	15.30	515.8	496.3	2.20	8.6	69.38
t statistic	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
% improvement	-1.35	-5.26	0.00	0.00	-18.50	13.40	6.57	13.64	11.63	13.38

Table 78. Pooled mean value of rearing performance conducted at REC, Mothabari

Fec. – Fecundity; ERR - Effective rate of rearing; SCW- Single cocoon wt.; SSW- Single shell wt. FL-Filament Length, NBFL- Non breakable filament length, Den. – Denier Rec.- Recovery

The pooled mean data of experimental rearing in two experimental sites show no significant positive improvement in cocoon quality & survivability of Transgenic hybrids except SR % and Denier at CSR&TI, Berhampore. The pooled rearing performance data were given in Table 77 & 78.

Conclusion: Two years pooled data consisting 09 trials (4 nos trials at REC, Mothabari, Malda and 5 trials conducted at CSR&TI, Berhampore) depicted that no significant impact was observed in Transgenic breeds/ hybrids than its control in respect of survivability and cocoon quality. Most of the case negative improvement observed cocoon quality.

10.B.I.7. BIOTECHNOLOGY SECTION

10.B.I.7. 1. PIB-3521: Assessment of promising powdery mildew resistance lines for perspective commercial use. (Jan., 2015 to Dec., 2017).

S Chattopadhyay (**PI**), R Banerjee (upto 01.07.2018) and A K Saha (upto 15.12.2016).

Objectives:

- Evaluation of powdery mildew resistant promising lines for foliage biomass and associated ancillary traits.
- Evaluation of silkworm rearing efficiency of the selected line(s) through bioassay. Development of segregating progeny using sib-mating from promising F_1 lines.
- Assessment of powdery mildew responsiveness of developed progeny using identified markers for MAS based utilization.

> Evaluation of powdery mildew resistant promising F_1 (pseudo- F_2)genotypes for foliage biomass, morpho-biochemical traits and silkworm rearing performance:

Eight promising powdery mildew (PM) resistance F_1 (Pseudo F_2) genotypes along with parental clones were established under RBD for thorough evaluation of phenotypic disease reaction, foliage biomass along-with various ancillary traits (morphological and biochemical), and silkworm bioassay with selected genotypes.

Altogether 5 rounds of disease scoring were conducted with the onset of natural incidence of PM coincided with during commercial silkworm rearing seasons of Aghrayani (Nov.) and Falguni (Feb.). Ten plants of each line were evaluated for PM disease reaction after about 60d of ground-level pruning of mulberry following 0 (resistant plants) to 10 (susceptible plants) logarithmic scale of Horsfall and Cowling. The genotypes exhibited 53% to 83% less DSI values than of susceptible superior parent S_1 (DSI: 23.1; Fig.17).



Fig.17. Mean disease severity index (DSI) of eight promising mulberry genotypes(pseudo-F₂) along with parents under field environment of Berhampore. S1=susceptible superior parent, Vietnam-2= resistant parent & S1635= ruling cultivar.

Table 79.	Mean	leaf biom	ass of	eight	promisii	ng powo	lery	mildew	resistant	mulberry
	genoty	pes along	with	parent	ts under f	field env	viron	ment of	Berhamp	ore

Progeny/ parent		Leaf biomass	
	gm plant ⁻¹	> S-1635 (%)	kg ha ⁻¹ crop ⁻¹
PMY-1	271.3		37679
PMY-2	328.4		45609
PMY-3	367.7	15.8	51068
PMY-4	299.5		41596
PMY-5	411.6	29.6	57165
PMY-6	288.4		40054
PMY-7	337.7	6.3	46901
PMY-8	327.3		45457
S-1635	317.6		44109
S-1	215.6		29943
LSD (p=0.05)	28.1		
CV (%)	12.8		

Data are mean of 11 seasonal values; 54 plants genotype⁻¹ season⁻¹ were evaluated.

Total 11 rounds of leaf biomass with other associated traits were also evaluated after 60 ± 5 days of basal pruning. Significant variability was observed for foliage biomass (Table 79) and associated morphological traits like leaf area, shoot length and total

number of shoot per plant (data not shown). Four promising lines confirmed the foliage biomass increment of ~5.8 to 29.6% over the recommended cultivar S-1635. Moreover, improvement of best performing genotype PMY-5 was consistent over the S-1635 to the tune of ~8% seasonal variation (data not shown).

For physiological and biochemical estimations, leaf samples from 5 plants of each genotype along with check were collected from fifth to ninth positions from top leaf after 60d of basal pruning. It appeared that $\sim 4\%$ thicker 9% increased leaf area with better plastidial pigments & 9% higher soluble sugar contents seem contributory for the better performance of PMY-5 than S-1635(Table-80).

Table 80. Mean performance of various physio-biochemical traits of most promising
mulberry genotype (PMY-5)along with superior parent (S_1) and ruling
cultivar (S_{1635}) under field environment of Berhampore

Genotype	SLA	LA	TChl	Carotd	Carotd TSS		TP
	(m ² kg ⁻¹)	(cm ²)	(mg g ⁻¹ FW)	(mg g ⁻¹ DW)			
PMY-5	19.8	236.6	0.90	0.22	24.6	31.3	0.28
S-1	24.5	90.4	0.63	0.17	18.3	26.6	0.22
S-1635	20.8	216.9	0.79	0.19	22.4	29.9	0.29
LSD(0.05)	0.77	14.7	0.007	0.005	0.48	0.99	0.015

Mean of two individual experiments (n= 3 for each expt); Specific leaf area (SLA); leaf area (LA), total chlorophyll (TChl), carotenoids (Carotd), total soluble sugar (TSS), total soluble protein (TSP) and total phenol (TP).

- > Evaluation of silkworm rearing efficiency of the most promising F_1 (pseudo- F_2) genotype PMY-5 through bioassay: Two seasonal rearings of silkworm hybrid B.Con.1 x B.Con.4 with most promising foliage yielding genotype PMY-5 indicated non-significant differences of major larval, cocoon and silk parameters with the check -S1635 (Table 82).
- **Table 82.** Mean seasonal performance of larval, cocoon and yarn parameters of
silkworm hybrid B.Con.1 x B.Con.4 fed with most promising genotype and
S1635 leaves during two favourable seasons

Parameter	PMY-5	S-1635	t statistic
Larval duration (Total)			
5 th instar:	7d12h	7d12h	ns
Total :	26d 12h	26d12h	ns
Percent of missing larvae(%)	9.3	10.1	ns
Pupation (%)	91	90	ns
Cocoon weight(g)	1.85	1.84	ns
Shell weight (g)	0.36	0.35	ns
Shell ratio (%)	19.4	19.0	ns
ERR	8854	8835	ns
By number	16.38	16.26	ns
By weight	63.52	62.03	ns

Data are mean of two rearing of Aghrayani 2016 and Falguni 2017(n = 3) with B. Con.1 x B.Con.4; 'ns' is non-significant at p < 0.05 using t-test.

> Development of successive generation by the sib-mating of promising F_1 genotypes and DNA profiling of promising lines with powdery mildew responsive putative markers:

Developed segregating F_2 (pseudo- F_3) progenies through sib-mating among three promising pseudo- F_2 genotypes were established in nursery. Two sib-mated F_2 descendants (~80 nos), preexisting ~120 F_1 (pseudo- F_2) population (derived from S-1 x Vietnam-2) along with parents were used subsequently for DNA profiling. Utilized these three generations progenies for phenotyping of PM diseases reaction and genotyping with CCMB provided ~30 PM responsive putative SCARs and SSRs.

In our two previous DBT supported projects with CCMB, we have identified a) some RAPD profiled DNA fragments putatively associated with PM resistance, b) these fragments were subsequently converted to SCARs (~30nos) markers by CCMB, c) subsequently, these SCARs and some in-house developed SSRs of CCMB was utilized in the genotyping of PM specific segregating populations (3 nos; total of ~375 F_1 progenies). Thirty of these putative PM specific markers (7 SCARs and 23 SSRs) were utilized in the present project.

Among these markers, three SCARs and 7 SSRs showed parental polymorphism (data not shown). All 14 parental polymorphic markers were subsequently used for 120 F_1 and 80 F_2 progenies along with their respective parental genotyping. A representative photograph of progeny profiling is given as Fig. 18.



Fig. 18. Amplification of powdery mildew responsive primer (MM-68) on F_1 mulberry progenies on 3% agarose gel. M=molecular marker of 50bp, R=resistant parent;S=Susceptible and P= progenies.

Based on the DNA profiling data, molecular mass of the major allelic bands were determined and correlated with the phenotypic PM disease severity index. It was observed that two SSR markers (MM68 and MM128) with the allele of ~182bp and

190bp showed strong association with phenotypic resistance reaction over three generation. Association of both bands with PM reaction was significantly increased in F2 over F1 progenies (Table 83).

 Table 83. Association of two specific SSRs (MM-68 and MM-128) with phenotypic disease reaction of powdery mildew over three generation

SSR /	Segregating	alleles (bp)	Genera-	Disease	Associat	tion with D	SI (%)	Potential
SCAR	Resistant	Recipient	tion	reaction	215bp	182bp	155bp	as marker
	donor	parent						link
MM-68	182, 155	215	F ₁	R	65.4	88.5	26.9	182bp
				S	94.7	18.1	21.3	allele+++
			F ₂	R	54.8	92.9	14.3	
				S	90.1	24.7	10.1	
MM-128	190, 175	205			215bp	190bp	175bp	190bp
			F ₁	R	97.1	73.2	24.1	allele+++
				S	99.4	23.3	20.4	
			F2	R	94.2	87.2	11.4]
				S	94.2	17.2	14.3]

Conclusion: One of the PM resistant genotype (PMY-5) exhibited ~29% more leaf yield potential over ruling cultivar S-1635. Significantly improved leaf thickness, area, plastidial pigments and total soluble sugar contents seem contributory for higher leaf biomass potential of PMY-5. Two of the allelic bands from SSR MM68(182bp) and MM128 (190bp) showed very strong correlation with phenotypic disease reaction over two generation. Correlations were increased with trait refinement from F_1 to F_2 (>80%), which indicated the possibility of the link of these two markers with traits.

Future plan: Identified better yielding genotype (PMY-5=C1360) has been approved by MVAC for AICEM-IV with a suggestion to generate one more year of data generation. Sequencing of identified putative linked allelic bands (2nos) to establish causal association with mulberry powdery mildew resistance.

10.B.I.5. 2. BPI(PS)010 : Identification of biochemical markers for thermo tolerance in silkworm Bombyx mori L. (Oct., 2016 to Sept., 2017).

Pooja Makwana (PI) and S Chattopadhyay.

Objectives:

- Identification of biochemical markers associated with ROS defense in bivoltine silkworm under thermal stress.
- Establishment of correlation between ROS defense associated enzymes and yield parameters.

> Identification of biochemical markers associated with ROS defense in bivoltine silkworm under thermal stress: In order to assess the association of thermal

stress tolerance properties of bivoltine silkworm breeds with reactive oxygen species (ROS) defense component(s) for breeding utilization, eleven bivoltine silkworm breeds (SK6, SK7, B.Con1, B.Con4, Gen3, SK4C, NB18, BHR2, BHR3, D6PN and CSR2) were reared in Oct.- Nov., 2017 and Feb-March, 2017. Initially all 11 breeds were exposed to high temperature (35° C and 40° C) with 75 to $80\pm5\%$ RH on first day of fifth instar. Control batches were reared at 25° C with $70\pm5\%$ RH.

Breed	Survival (%)		Pupation (%)	
	25°C	35°C	25°C	35°C
SK6	88.68	50.50	88.5	54.6
SK7	89.20	54.35	90.0	54.7
BCON1	87.42	63.22	88.0	56.0
BCON4	88.75	67.82	91.0	60.2
BHR2	85.18	59.35	87.5	50.0
BHR3	83.50	61.68	89.0	60.0
D6PN	79.17	58.57	87.5	46.2
NB18	80.30	44.83	86.4	54.4
Gen3	82.50	54.53	88.4	55.5
SK4C	83.78	55.87	89.8	58.7
	CD at 5%	SE(m)±	CD at 5%	SE(m)
Temp	0.43	0.15	0.38	0.14
SW	0.97	0.34	0.85	0.30
T X SW	1.37	0.48	1.21	0.43

 Table 84. Variation in survival (%) and pupation (%) of control and temperature stressed silkworms

Data are mean of two seasonal experiments with 3 observations per season

Table	85.	Variation	in	Hydrogen	peroxide,	MDA	levels	and	SOD	activity	in
		hemolym	ph c	of control an	d temperati	ure stres	ssed silk	worn	ns		

Breeds	Hydrogen peroxide (µM)		MDA (nmol	mg ⁻¹ protein)	SOD	
				-	(moi UA/m	ig protein)
	25°C	35°C	25°C	35°C	25°C	35°C
SK6	6.44	7.99	33.12	91.18	5.6	7.46
SK7	5.27	6.29	45.59	143.66	2.67	7.63
BCon1	4.34	8.26	27.09	233.55	3.76	7.64
BCon4	3.77	8.39	21.07	206.45	4.79	8.16
BHR2	2.48	7.10	25.37	53.33	3.45	7.73
BHR3	4.99	7.54	27.53	66.77	5.45	7.97
D6PN	4.93	5.62	15.48	169.03	2.39	6.35
NB18	3.06	5.96	11.61	27.09	5.05	6.48
Gen3	2.73	5.45	15.48	26.24	2.37	6.66
SK4C	3.72	4.40	13.33	35.69	3.65	6.46
	CD at 5%	SE(m)±	CD at 5%	SE(m)±	CD at 5%	SE(m)±
Temp	0.22	0.08	3.61	1.28	0.09	0.03
SW	0.50	0.18	8.07	2.87	0.20	0.07
T X SW	0.71	0.25	11.42	4.06	0.29	0.10

Data are mean of two seasonal experiments with 3 observations per season

None of the breeds survived at 40 °C. However at 35°C of thermal stress regime, breeds showed varying degrees of survival (range: 43% to 67.8% of respective control values) (Table 84); while, the susceptible check (CSR2) did not survived even at 35°C. In the hemolymph protein, tested ROS associated non-enzymatic parameters such as hydrogen peroxide (H₂O₂) and lipid peroxidation (MDA levels) and enzymatic parameters like superoxide dismutase (SOD), ascorbate peroxidase (APOX) and catalase (CAT) were assessed. H₂O₂ and MDA levels were significantly ($p \le 0.01$) higher in all temperature stressed breeds compared to their respective controls (Table 85). Similarly SOD, CAT and APOX activities were significantly ($p \le 0.01$) higher in hemolymph of temperature stressed larvae compared to control.

Correlation between ROS defense associated enzymes and yield parameters: Pearson correlation matrix was determined to ascertain the relationship among the tested larval / cocoon (survival rate, larval weight, single cocoon weight, single shell weight, shell ratio, pupation rate) and ROS response (H_2O_2 levels, MDA levels, SOD, CAT and APOX) parameters. Lipid peroxidation and ascorbate peroxidase (APOX) showed non-significant relation with the survival and pupation of the breeds. Catalase showed significant association with survival but non-significant with pupation. Therefore these biochemical parameters may not be useful as selective markers for the assessment of temperature stress in mulberry silkworm. However, SOD activity and endogenous H_2O_2 titer showed highly significant correlation with survival (SOD: r =0.47; $p \le 0.01$ and H₂O₂: r = -0.26; $p \le 0.05$) of the silkworm breeds along with pronounced breed variations of obtained values (Table 86). It indicates prospective role of these two ROS components with the survival of the silkworm under temperature stress along with the possibility to use as selective markers. From tested 10 effective breeds, B.Con.4 followed by B.Con.1 and BHR3 are found to be the better performing breeds than others in respect of higher survival and ROS defense associated SOD activity.

	Survival (%)	H ₂ O ₂	LPO	SOD	CAT
Survival (%)	1				
H2O2	-0.260*	1			
LPO	0.200	0.520	1		
SOD	0.472**	0.180	0.212	1	
CAT	0.293*	0.330	0.53	0.065	1
ΑΡΟΧ	0.103	0.115	0.509	-0.071	0.645

Table 86. Correlation of survival rate and antioxidant enzyme activity in hemolymph of control and temperature stressed silkworms

*p<0.05 (critical value 0.25) and **P<0.01 (critical value 0.325); (df=60)

Conclusion: Identified three temperature stress tolerant bivoltine breeds (BCon4 > BCon1>BHR3) on the basis of survival, pupation and ROS stabilization enzyme activities. With significant breed variation and highly-significant correlation with

survival, SOD activity showed potential to use as a selective markers of temperature stress in silkworm *Bombyx mori*.

Future plan: Better performing breeds (BCon4, BCon1 and BHR3) and protective role of SOD need to be studied thoroughly for their consistent performance and utilisation in the temperature stress tolerant hybrid development programme of *Bombyx mori*.

11.B.II.RSRS, JORHAT, ASSAM

11.B.II.1.B-JRH (P) 040: Studies on mulberry germplasm in Agroclimatic conditions of North Eastern States. (Apr., 2015 to Aug., 2017).

M. Pamehgam (PI) and S. N. Gogoi.

Objectives:

- To established mulberry field gene bank with the collections from northeastern region.
- To identify a promising mulberry accession for commercial utilization.

Results:

 Table 87. leaf yield of mulberry germplasm

#	Accession	Name	Donor	Leaf yield (yr/ ha /t/ crop)	Moisture (%)
1	MI-0884	•	CSGRC, Hosur	10.427	72.65
2	MI-0354	Dilma-1	CSGRC, Hosur	8.117	73.35
3	MI-0395		CSGRC, Hosur	7.290	72.54
4	MI-0807		CSGRC, Hosur	6.743	71.14
5	MI-0151	Phayang heigrangamna	CSGRC, Hosur	7.717	71.17
6	MI-0359	Garbandha-3	CSGRC, Hosur	3.307	72.44
7	MI-0879	•	CSGRC, Hosur	10.850	73.12
8	MI-0875		CSGRC, Hosur	8.713	74.38
9	MI-0342	Moulai lobed-1	CSGRC, Hosur	9.307	71.49
10	MI-0106	Heipanbi	CSGRC, Hosur	8.107	72.25
11	MI-0344	Pangree local	CSGRC, Hosur	7.817	72.26
12	MI-0358	Dilma	CSGRC, Hosur	8.907	72.33
13	MI-0357	Garbandha-1	CSGRC, Hosur	9.023	72.99
14	MI-0355	Umlong local lobed	CSGRC, Hosur	9.307	69.91
15	MI-0349	Garbandha-2	CSGRC, Hosur	11.217	72.14
16	MI-0845	•	CSGRC, Hosur	9.537	71.21
17	MI-0844	•	CSGRC, Hosur	7.937	68.18
18	MI-0255	Nanabana Centre	CSGRC, Hosur	8.680	72.55
19	MI-0356	Chongpatgiri	CSGRC, Hosur	8.567	72.16
20	MI-0877		CSGRC, Hosur	7.943	69.87
21	MI-0346	Tingari local	CSGRC, Hosur	7.573	72.11
22	MI-0873	•	CSGRC, Hosur	7.943	69.12
23	MI-0090	Monla	CSGRC, Hosur	7.610	68.22
Con	S1635			11.149	73.28
SEm	±			0.341	0.47
CD a	nt 5%			0.707	0.97

The growth and leaf yield characters of 23 mulberry accessions were studied. Highest leaf yield was recorded in MI-0349 (11.217 mt/ha/yr.) among the 23 accessions and it was at par with S-1635 (11.15 mt/ha/yr) (Table 87). Maximum leaf rust disease incidence was recorded in MI-0354 (0.70 PDI) followed by MI-0395 (0.56 PDI) and MI-0873 (0.50 PDI). Maximum mealy bug infestation was recorded in MI-0844 (2.13 no/ pl) followed by MI-0875 (1.79 no./pl).

The analyzed data shows that cocoon yield, ERR by No. and by Wt. was significantly high in MI-0349(62.00 k/100 dfls/8748 no./ERR by wt. 15.502 kg) followed by MI-0807 (62.00 kg/ 8852 nos/ 15.02 kg). Thus single cocoon weight was recorded high in MI-0349 (1.772 g) followed by MI-0849 (1.767 g), single shell weight was recorded high in MI-0354 (0.310 g) followed by MI-0845 (0.307 g) and high shell percentage was recorded in MI-884 (18.54%) followed by (18.27%) in test rearing (Table 88).

Accessions	Single Cocoon	Single Shell	SR%	ERR by	ERR by wt.	Yield /100
No.	wt (g)	Wt. (g)		10000 larvae	larvae (Kg)	dfls (kg)
				(No.)		
MI-0884	1.680	0.273	18.54	7342	12.335	49.340
MI-0354	1.596	0.310	17.22	8561	13.649	54.966
MI-0395	1.550	0.274	17.22	8907	13.806	55.224
MI-0807	1.697	0.267	17.46	8852	15.020	60.080
MI-0151	1.672	0.296	17.29	6848	11.516	46.064
MI-0359	1.683	0.290	16.10	6904	11.541	46.164
MI-0879	1.677	0.271	18.27	8301	13.924	55.696
MI-0875	1.621	0.306	17.07	8000	12.965	51.860
MI-0342	1.687	0.277	16.83	7054	11.880	47.520
MI-0106	1.623	0.285	16.90	8195	13.303	53.212
MI-0344	1.641	0.274	16.15	8653	14.199	56.796
MI-0358	1.617	0.265	16.39	8207	13.271	53.084
MI-0357	1.653	0.265	15.88	7002	11.573	46.292
MI-0355	1.697	0.262	15.99	6989	11.861	47.444
MI-0349	1.772	0.271	17.33	8748	15.502	62.008
MI-0845	1.767	0.307	16.40	8388	14.821	59.284
MI-0844	1.753	0.290	15.20	8499	14.901	59.604
MI-0255	1.596	0.266	15.74	7858	12.551	50.204
MI-0356	1.663	0.257	15.88	8254	13.734	54.936
MI-0877	1.593	0.159	16.72	8287	13.204	52.816
MI-0346	1.650	0.266	16.67	7651	12.624	50.496
MI-0873	1.610	0.275	17.04	7403	12.185	48.740
MI-0090	1.570	0.270	16.41	7705	12.097	48.380
S1635(con)	1.647	0.258	16.66	7401	12.189	48.756
SEm±	0.013	0.006	0.18	137	0.252	0.950
CD at 5%	0.028	0.012	0.38	283	0.522	2.802

Table 88. Rearing performance of mulberry germplasms

11. LIST OF ALL INDIA COORDINATED RESEARCH PROJECTS HIGHLIGHTS / AUTHORIZATION PROJECTS HIGHLIGHTS

11.1.1. AIB 3545: Authorization trial of silkworm hybrids in Eastern and North-Eastern India. (Aug., 2015 to Mar., 2018*) [*As per CO order, project was extended from July 2017 to March, 2018]

Highlight:

Eastern India, especially the state of West Bengal experiences extreme variation in temperature, relative humidity and rainfall. According to climatic conditions, the commercial seasons are broadly divided into two, favourable and unfavourable. The former falls between October to March, when the climatic conditions are congenial for silkworm rearing. Autumn (Nov) and Spring (Feb) crops come during this period. April (Baisakhi), commercial crop is also considered as partially congenial for silkworm rearing in terms of prevalence of low humidity. On the other hand, the unfavourable period with prevailing high temperature and humidity conditions starting from May to September are not conducible for silkworm rearing of June-July (Shravani) and Aug-Sep (Badhuri & Aswina) crops. Because of high temperature and humidity as well as rainfall, most of the rearers are compelled rear indigenous breed, Nistar, which is very low productive with poor quality. But suitable multi x bi hybrid can successfully be reared during autumn and spring seasons of the plains, which could increase the silk production. The present study has corroborated the idea that new hybrids other than Nistari based hybrids can successfully be reared in West Bengal and similarly new bivoltine hybrids in North -Eastern states and during favourable seasons in West Bengal can also be reared successfully.

Based on the overall performance at farmers field, during favourable seasons (Agrahayani, Falguni and Baishaki) it is recommended to rear the multivoltine hybrids, *M6DPC* x (*Sk6* x *SK7*) in West Bengal and Jharkhand states. With regard to bivoltine hybrids, it was recommended to rear *B.Con.1* x *B.Con.4* in West Bengal, Jharkhand and North Eastern states. *Both the hybrids have been authorized by HAC of Central Silk Board on 19.02.2018*. Both the hybrids will be utilized in the field as ruling hybrids.

12. CENTRAL COLLABORATIVE PROGRAMME: BIVOLTINE CLUSTER PROMOTION PROGRAMME IN EASTERN & NORTH-EASTERN ZONE

Zonal Coordinator: Dr Kanika Trivedy, Director, CSR&TI, Berhampore **Zonal Nodal Officer:** G. C. Das, Scientist-D, CSR&TI, Berhampore

The Bv CPP is operating through 15 (Fifteen) clusters in Eastern & North Eastern region covering eight state viz. West Bengal (4), Odisha (2), Bihar (1), Assam (3), Manipur (2), Mizoram (1), Nagaland (1) and Tripura (1) with the active support of the respective DOSs & CSB for promotion of bivoltine silk production. The Bivoltine Cluster promotion programme was successfully completed the tenure of its XII five years plan (2012-13 to 2016-17) with notable increase in raw silk production (210.9 t) during 2016-17 than its initial years 2013-14 (44.61t). The Central Silk Board has taken decision to extend the CPP for another 3 years (2017-2020). During 2017-18, total **31.47** lakhs dfls (BV 15.22 lakh & ICB 16.25 lakh) were reared againest the target of **33.10** lakh (BV 24.40 lakh & ICB 8.70 lakh) dfls with 95.94% achievment. Raw silk production was 185.58 mt (BV 98.60 mt & ICB 86.99 mt) with 102.35% achievment againest the target of 181.33 mt (BV 146.73 mt & ICB 34.60 mt) and cocoon yield kg/100 dfls was 50.41 kg in Bivltine & 45.81 kg in ICB. On the whole, Eastern zone cluters are always achievening thier targets successfully (except Odisha clusters) as compare to NE zone clusters.

For effective monitoring of the clusters, JCPCs meeting were conducted bimonthly to review the progress and chalk out the future plan of action. Zonal bivoltine Review Committee meetings were held half yearly to review the progress of the clusters.



Fig. 18a. Years Production at a glance (2013-14 to 2017-18)

Cluster	Farmers profile	Farmers	Mulberry (Acre)	Mobile No
	uploaded	covered		
Malda, W. B.	526	850	263	126
Murshidabad, W. B.	1738	867	599	1340
Birbhum, W.B.	212	320	106	41
Nadia, W. B.	632	342	295	412
Ghatgaon, Odisha	320	75	320	60
Kashipur, Odisha	213	201	201	6
Kishanganj, Bihar	230	277	115	120
Darrang, Assam	556	556	378	164
Udalguri, BTC, Assam	375	375	217	169
Jorhat, Assam	400	325	205	123
Churachandpur, Manipur	628	320	417.9	40
Ukhrul, Manipur	576	320	552	136
Aizawl, Mizoram	300	300	300	221
Paren, Nagaland	328	325	328	157
Champaknagar, Tripura	474	394	294	27
Total	7508	5847	4561	3142

Table 93a. Farmers' details uploaded in Seri5k portal

Table 93b. ECP conducted under Bv CPP & farmers sensitized.

#	Programme	Target (2017-18)	Achievement (2017-2018)	
		# events	# events	# persons sensitized
1.	Field Day	30	27	2542
2	Awareness Programme.	30	29	1885
3.	Group Discussion	30	31	1230
4.	A.V. Programme	30	28	1272
5.	Exhibition	30	29	1480
Total		150	144	8409



Fig. 18b. Bv Silk Production (E & NE Zone) 2017-18



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Fig. 18c.ICB Production in Eastern Zone during 2017-18

Table 93c. CF	P production	at a glance:	target vs	production	2017-18
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	Dfls (Lakh)	Achiev.	Actual Yield/		Raw s	ilk (MT)	Achiev
	Target	Achiev.	(%)	Cocoon	100 dfls	Target	Achiev.	(%)
	-			Yield (t)	(kg)			
BV Prodn. Eastern Zone	6.90	5.67	82.10	300.95	53.13	57.23	38.47	67.23
BV Prodn. of NE Zone	17.50	9.81	56.06	479.23	48.85	89.50	60.12	67.18
Total BV Prodn.	24.40	15.48	63.42	780.18	50.41	146.73	98.60	67.20
ICB prodn.	8.70	16.25	186.78	744.34	45.81	34.60	86.99	251.42
Grand Total	33.10	31.73	95.94	1524.52	48.01	181.33	185.58	102.35

Table 93d. ICB p	production un	der CPP	(Easter Z	lone) during	2017-18
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#	Cluster	Dfls (Lakh)	Achiev.	Cocoon	Yield/	Raw	silk (t)	Achiev.
		Target	Achiev.	(%)	yield (t)	100 dfls (kg)	Target	Achiev	(%)
We	est Bengal								
1	Malda	2.00	4.112	205.60	184.035	44.76	8.0	18.403	230.04
2	Murshidabad	2.00	2.800	140.00	139.700	49.89	8.0	13.970	174.63
3	Birbhum	2.00	6.231	311.55	271.335	43.55	8.0	27.134	339.17
4	Nadia	2.00	2.697	134.85	133.228	49.40	8.0	13.284	166.05
	Total	8.00	15.840	198.00	728.298	45.98	32.0	85.390	266.84
Od	lisha								
1	Ghatgaon	0.25	0.085	34.00	2.104	24.75	0.8	0.210	26.25
2	Kashipur	0.25	0.008	3.20	0.174	21.75	1.0	0.016	1.60
	Total	0.50	0.093	18.60	2.278	24.49	1.8	0.226	12.56
Bihar									
1	Kishanganj	0.20	0.320	160.00	13.770	43.03	0.8	1.377	172.13
	Frand Total of CB Production	8.70	16.250	186.80	744.346	45.80	34.6	86.990	251.42

#	Cluster	Cluster Dfls (Lakh)		% Achmnt	Actual	Yield/	Raw silk (t)		%
		Target	Achmnt		cocoon	100 dfls	Target	Achmnt	Achmnt
					yield (t)	(kg)			
We	st Bengal							-	
1	Malda	2.09	2.182	104.40	108.06	49.52	19.30	13.50	69.95
2	Murshidabad	1.63	1.630	100.00	100.87	61.88	15.05	12.61	83.79
3	Birbhum	0.55	0.550	100.00	30.250	55.00	5.07	4.075	80.37
4	Nadia	0.63	0.645	102.38	35.175	54.53	5.81	4.764	82.00
	Total	4.90	5.007	102.18	274.35	54.79	45.23	34.95	77.27
Od	isha								
1	Ghatgaon	0.75	0.085	11.33	1.052	12.38	5.00	0.116	2.32
2	Kashipur	0.75	0.073	9.67	1.730	23.86	5.00	0.432	8.64
	Total	1.50	0.158	10.50	2.782	17.66	10.00	0.548	5.48
Bih	ar							•	•
1	Kishanganj	0.50	0.50	100.0	24.992	49.98	3.13	3.12	99.68
Тс	otal of Eastern	6.90	5.665	82.09	300.95	53.13	57.23	38.47	67.23
	Zone								
As	sam & BTC								
1	Darrang	2.00	1.741	87.05	86.082	49.44	10.50	10.76	102.48
2	Jorhat	2.00	0.795	39.75	34.305	43.15	10.50	4.29	40.84
3	Udalguri	2.00	0.900	45.00	38.630	42.92	10.50	5.50	52.38
	Total	6.00	3.436	57.27	183.017	53.26	31.50	18.55	58.88
Miz	zoram								
1	Aizawl	2.50	0.860	34.40	41.880	48.70	10.00	10.46	104.60
Nag	galand								
1	Peren	2.00	1.050	52.50	43.860	41.77	12.00	5.19	43.25
Ма	nipur								
1	Churach'pur	2.50	1.800	72.00	86.330	47.96	12.50	10.74	85.92
2	Ukhrul	2.50	1.620	64.80	78.950	48.73	12.50	9.86	78.88
	Total	5.00	3.420	68.40	165.28	48.33	25.00	20.60	82.40
Tri	pura	•						•	•
1	West Tripura	2.00	1.045	52.25	45.190	43.24	11.00	5.33	48.42
Т	otal of NE Zone	17.50	9.811	56.06	479.23	48.85	89.50	60.12	67.18
	Grand Total	24.40	15/18	63 / 2	780 18	50 / 1	1/6 73	08 60	67 20

Table 93e. Bv production at 15 CPP (Easter & NE Zone) during 2017-18



View of the ZBCPP meeting held on 23.08.2017



View of the ZBCPP meeting held on 0.01.18

#	Cluster	C.S.B Facilitators		DoS Facilitators			
		Name, Designation & address	Mobile No.	Name, Designation & address	Mobile No.		
1.	Malda, W.B.	Dr. S. Chakraborty, Sci-C REC, Mothabari, Malda <u>satadal.chak@gmail.com</u>	9474580417 & 8001237468	Shri Manoj Kr. Baidya, Dy. Director of Textile (Seri), Malda, W.B. <u>malseri2@gmail.com</u>	9434723094		
2.	Murshidabad, W.B.	Dr. (Mrs) T. Dutta (Biswas), Sci-D, REC, Kamnagar, Msd reckamnagar@gmail.com	9126331586	Shri Manoj Kr. Baidya, Dy. Director of Textiles (Seri), Berhampore, Msd. <u>berseri1@gmail.com</u>	9434723095		
3.	Birbhum, W.B.	Dr. (Mrs.) Manoja Patnaik , Sci-D, SSPC, Kalitha, Birbhum <u>manoja ctp@rediffmail.com</u>	9434747385	Shri S. K. Das, Dy. Director of Textiles (Seri), Suri, Birbhum, W.B. <u>birseri@gmail.com</u>	9434723134		
4.	Nadia, W.B.	Shri G. C. Das, Scientist-D CSR&TI, Berhampore, MSD gopaldascsb@rediffmail.com	9434229425	Shri Supratim Das, Asstt. Director of Textiles (Seri), Krishnagar, Nadia nadiseri@gmail.com	9434723249		
5.	Kishanganj, Bihar	Shri Bimal Ch. Ray, Sci-D, MESDP, Kishangani, bimalmitali@rediffmail.com	9434056081	Shri N. P. Verma Asstt. Director, Industry (Seri), DoS, Govt. of Bihar, Purnea, Bihar.	7870144800		
6.	Kashipur, Rayagada Odisha	Dr. K. C. Brahma, Sci-D, RSRS, Koraput- Odisha <u>Kcbrahma58@gmail.com</u>	9438656939	Shri B. K. Mishra Asstt. Director (Seri), DoS, Koraput, Odisha	9438470533		
7.	Ghatagaon, Keonjhar Odisha	Shri Satyabrata Dey, Sci-C, REC, Dhenkikota-, deysatyabrata1959@gmail.com	9438709173	Shri R.C. Mahapatra Asstt. Director (Seri),Keonjhar , adskeonjhar@yahoo.com	9437454580		
8.	Darrang, Assam	Dr. B. K. Basumatary, Sci-D, Darrang, Assam	9435304453	Sri H.S. Dewan, Asst. Director (Seri), DOS, Darrang, Assam	8472086743		
9.	Jorhat, Assam	Smt. Mina Pamehgam, Sci-C, RSRS, Jorhat, Assam pamehgamt@gmail.com	9365456012	Shri Gobin Kolitha Extension Officer, DOS, Jorhat, Assam	9435518260		
10.	Udalguri, BTC, Assam	Shri. B.N. Chowdhuri SciD RDO, Guwahati, Assam bidyutnc10@yahoo.com/	9435054191	Sri H. K. Hazarika , Assistant Director (Seri), DOS, Udalguri, BTAD, Assam	9435184587		
11.	Aizawl, Mizoram	Dr. L. Pachuau, Sci C, REC, Chaltlang Aizawl Mizoram, <u>thlatea@rediffmail.com</u>	9435087588	Sri Lalremsiama, Asstt. Director, DoS, Govt. Of Mizoram, Chaltlang Aizawl, PIN-796012	9436199948		
12.	Ukhrul, Manipur	Dr. L. Somen Singh, Sci-D, REC, Imphal, Manipur somen_laishram@yahoo.com	9436033596	Sri John Lakshang, Asstt. Director, Dist.Sericul. Office DoS, Govt. of Manipur, Ukhrul, Manipur	8416096202		
13.	Churachand- pur, Manipur	Dr. L. Somen Singh, Sci D, REC, Imphal, Manipur somen_laishram@yahoo.com	9436033596	Shri G. Vunglian, Asstt. Director, Dist.Sericul. Office DoS DoS, Govt. of Manipur, Churachandpur,	9862113806		
14.	Paren, Nagaland	Dr. Anukul Barah, SciD, REC, Dimapur, Nagaland anukul_barah@rediffmail.com	9435353962	Shri Yashimeren, District Sericulture Officer, DOS, Dimapur, yashilongchar@gmail.com	9436436237		
15.	Champaknaga r, West Tripura	Dr. G.B. Singh, Sci-D, REC, Agartala, Tripura sgbcrsti@rediffmail.com	9615179959	Sri Jyoti Bikash Chakma Superintendent of Sericulture, DOS, Agartala , Tripura	9436509681		

Table 93f. Clusterwise CDF (CSB & DoS) entrusted for CPP activity:

12. B. LIST OF INTER-INSTITUTIONAL COLLABORATING PROJECTS – (along with the name of Coordinator and the investigators from each of the collaborating institute)

12. B. Projects: 8 Nos

1. PIB 3505: Development of drought tolerant mulberry variety for rainfed sericulture. (Jan., 2014 to Dec., 2019). [*Collaborative project with CSGRC, Hosur]

Investigators: Suresh, K. (**PI**) and P.K. Ghosh (upto 30.06.2017), D. Chakravarty (fr.-01.07.2017), Anil Pappachan and K Jhansi Lakshmi* and A. Sahay* (fr. 01.04.2016).

2. PPE 3517: Population Interaction of Pest and natural enemies in mulberry ecosystem. (Aug., 2014 to July, 2017) [*Collaborative with National Bureau of Agricultural Insect Resources, ICAR, Bangalore].

Investigators: S. Chanda (**PI**) and D.Das, U.C Boruah, Ranjit Kar, Ankita Gupta* and Pratheepa*.

3. ARP 3522: Isolation, cloning and characterization of antibacterial protein (s) from silkworm, *Bombyx mori*. (May, 2015 to Jun., 2018). (*Collaborative project with SBRL, Kodathi, Bangalore)

Investigators: K.Rahul (fr. 03.07.16) & S. Chakrabarty (upto 02.07.16), G. Ravikumar* (**PI**), Zakir Hossain, Sci-D (fr. 09.08.2016), Shri Gourab Roy (**JRF**).

 AIB 3577: Evaluation of multivoltine germplasm to identify potential parents for developing cross breeds for Southern & Eastern India. (Jun., 2016 to Sept., 2019). (*Collaborative with CSGRC, Hosur and *CSRTI, Mysuru).

Investigators: G.C.Das (Fr. Dec. 17), Z. Hossain [Upto Nov., 17] (**PI**) & N. Chandrakanth (fr. CSRTI, Berhampore), N. Balachandran*, M. Muthulakshmi*, G. Thanavendan* and S. Nivedita*, K. K. Sharmila[#], Dayananda[#] and Y.C. Radhalakshm[#].

5. AIB 3578: Evaluation of exotic bivoltine silkworm breeds to identify promising parental genetic resources. (Jun., 2016 to Sept., 2019). (*Collaborative with CSGRC, Hosur; ¹CSGRC, Hosur; ²CSRTI, Mysuru and ³CSRTI, Pampore).

Investigators: A. K. Verma and Zakir Hossain, G.C. Das, M. Muthulakshmi^{*}, Veeranna Gowda^{*}, Anuradha^{*}, H. Jingade¹, S. Nivedita¹, C. M. Kishor Kumar², P. V. Soudaminy², Babulal³ and D. Guruswamy³.

6. **ARP 3605:** Validation of the DNA makers in silkworm breed developed by introgression of DNA markers associated with NPV resistance using Marker Assisted Selection breeding and large scale field trial of the breed. (Apr., 2017 to Mar., 2020) [DBT funded Collaborative Project with SBRL*]

Investigators: Gopal Chandra Das (PI), N. Chandrakanth and Arbind Awasthi*

7. AIB 3545: Authorization Trial of Silkworm hybrids in Eastern and North Eastern India. (Aug., 2015 to Mar., 2018). [*Collaborative with NSSO, Bangalore and CSTRI, Bangalore].

Coordinators: K.Trivedi, Director, CSR&TI, Berhampore and *Director, NSSO, Bangalore and CSTRI, Bangalore.

Investigators: A. K. Verma, N. Suresh Kumar (upto- 31.05.2016) and V. Lakshman (fr.- 06.08.2016)

8. AIT 3557: Multi-locational trial on transgenic Bm NPV resistant silkworm strains to establish their efficacy and generate data for their regulatory approval. (Jan., 2016 to Aug., 2017) (*Collaboration with APSSRDI, Hindupur, Andhra Pradesh).

Coordinators: Dr. K.Trivedi, Director, CSR&TI, Berhampore and *Director, APSSRDI, Hyderabad, Andhra Pradesh.

Investigators: Gopal Chandra Das (fr. 01.03.2017), Jayeeta Sarkar (upto 28.02.2017) and S. Roy Chowdhury (upto 23.07.2016).

13. CONTINUOUS / ROUTINE PROGRAMME

#	Code No.	Title	PI
1.	BPI(P)	Maintenance of mulberry germplasm bank	Suresh, K
	025	at CSR&TI, Berhampore (W.B). (Jan., 2013	SciB
		to Dec., 2018)	
2.	BAI (RP)	Maintenance of multivoltine and bivoltine	V. Lakhsmanan,
	003	germplasm (Jan., 2016 to Dec., 2018)	SciD & A. K.
			Verma, SciD
3.	BAI (RP)	Silkworm disease monitoring of seed and	Z. Hossain,
	021	commercial crop rearing of West Bengal	Sci-D
		(SDMSCC) [A collaborative Programme	S. Chakrabarty,
		with ZSSO, Malda & DoT (Seri), W.B.]	Sci-C
		(Apr., 2016 to Mar., 2019)	
4.	BPR	Survey and surveillance of mulberry pest in	S. Chanda,
	(RP) 022	Eastern and North-Eastern region of India.	Sci-D
		(Jun., 2016 to May, 2021)	
5.	B-MOE(P)	Seri Model Village (Sept., 2017 to Aug.,	D. Das, SciD
	043	2020)	
6.	B-MOE (P)	Adarsh Swachh Resham Gram Programme at	N. Chandrakanth
	044	Mallickpur-Diara Village (Apr., 2017 to	(w.e.f. 01.02.18),
		Mar., 2019)	Shafi Afroz (up to
			31.01.18)
7.	B-PRP (P)	Forewarning of mulberry diseases of Eastern	A.Pappachan,
	045	and North Eastern India. (Jan., 2018 to Dec.,	Sc1-B
		2020).	
8.	B-KPG (RP)	Maintenance of bivoltine silkworm	R. Kar,
	017	germplasm. (Apr., 2015 to Mar., 2020)	Sci-D
9.	JRH-PRP	Studies on mulberry germplasm in agro-	Mina
	(P) 046	climatic condition in North East State,	Pamegham,
		Assam. (Sept., 2017 to Aug., 2020)	Sci-C

13.1. MULBERRY BREEDING AND GENETICS SECTION

13.1.1.BPI(P)025:Maintenance of mulberry Germplasm Bank at CSR&TI, Berhampore (W.B.). (Jan., 2013 to Dec., 2018).

D. Chakravarty (**PI**- w.e.f. 01.01.2017), K. Suresh (**PI**- up to 30.06.2017), Anil Pappachan.

Objective: Maintenance of mulberry germplasm bank for using them in breeding programme.

A total of 219 mulberry germplasm accessions comprising of 12 Morus species were

maintained in the field gene bank under subtropical sericulture region at CSR&TI, Berhampore, West Bengal following recommended cultural practices (Table 89).

Table 89. List of indigenous and exotic accessions of diffe	erent species of mulberry
--	---------------------------

#	Name of the Species	Indigenous	Exotic	Total
1	M. alba Lin.	32	39	71
2	M. indica Lin.	83	5	88
3	M. latifolia Poir.	3	28	31
5	M. bombycis	0	14	14
5	M. laevigata	6	0	6
6	M. multicaulis	0	2	2
7	M. australis Koitz.	0	2	2
8	M. nigra Lin.	0	1	1
9	M. rotundiloba	0	1	1
10	M. rubra	0	1	1
11	M. tiliafolia	0	1	1
12	M. cathyana Hemsl.	0	1	1
	Total	124	95	219

13.2. SILKWORM BREEDING AND GENETICS SECTION

13.2.1.BAI (RP) 003Maintenance of Multivoltine and Bivoltine Germplasm.

V. Lakhsmanan (PI), A. K. Verma and N. Chandrakanth.

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

#	Name	#	Name	#	Name			
BIVOLTINE - OVAL								
01	KPGA	09	SK3C	17	SP2			
02	KPGB	10	SK3N	18	KSO1			
03	KPG11	11	YB	19	GEN3			
04	SK3	12	NBO1	20	BHR2			
05	MC4 (E)	13	NBO2	21	BG(W)			
06	MC4 (O)	14	NBO3	22	SH6			
07	MC2	15	NBO4					
08	CSN	16	CSR47					
BIVOLTINE - D	UMBBELL							
23	SK6	33	Chinese Pea nut	43	MJ ₂			
24	SK7	34	NBP ₄	44	RSJ1			
25	NB18	35	NP2	45	DUN22			
26	P5	36	D6(M)	46	JPN			
27	B.Con.1	37	BHR1	47	J112			
28	B.Con.4	38	BHR3	48	SK6 (SL)			
29	D6PN	39	SK4	49	SK7 (SL)			
30	SK4C	40	D5	50	NB4D2 (SL)			
31	D6(P)	41	SK4N					
32	NB4D2	42	MJ ₁					

Table 90a. List of the bivoltine germplasm.


A total of 50 bivoltine and 31 multivoltine silkworm breeds/ strains were maintained as stock lots conforming to their original breed characteristics. Multivoltine breeds are reared 5 to 6 times in a year whereas bivoltine 2 times. List of the bivoltine and multivoltine germplasm are given in Table 90a & 90b.

#	Name		#	Name	#	Name			
MULT	MULTIVOLTINE : ELLIPTICAL / SPINDLE								
51	1	M. Con.4	60	M ₂ B	69	M12(W) (SL)			
52	2	M. Con.1	61	Pure Mysore	70	M12(W) (SL)			
53	3	M15	62	Sarupat	71	MH1			
54	1	M6DPC(Im)E	63	Nistari Plain	72	BL67			
55	5	M6DPC (Gc)	64	Nistari Marked	73	ND7			
56	ô	M6DPC	65	Nistari Debra	74	Nistari Chalsa			
57	7	M6M81	66	Nistari White	75	M.Con 4 ^{Id} (NP)			
58	3	M12(W)	67	M.Con 4 ^{id} (P)					
59	9	Cambodge	68	Nistari (SI)					
MULT	IVOLT	INE - OVAL							
76	ĵ	M9A	78	O (Oval)	80	G			
77	7	CB5	79	M2	81	OS616			

Table 90b. List of the multivoltine germplasm.

13.3. SILKWORM PATHOLOGY SECTION

13.3.1. BAR (RP)021 : Survey, surveillance and monitoring of silkworm diseases in seed and commercial crops in Eastern and North Eastern India (*In collaboration with RSRSs, RECs, DOS and NSSO*). (April, 2016 to March, 2019).

Chief Executive Autority: Dr.K.Trivedy, Director, CSR&TI, Berhampore

Co-Ordinators: Director, DoT(Seri), Govt. of West Bengal, Odisha, Jharkhand and Assam and Scientist-D, NSSO, West Bengal, Odisha, Jharkhand and Assam.

PI: Zakir Hossain, Sci-D

CI (**CSR&TI**): Smt. C. Maji, Sci-D; Dr. S. Chanda, Sci-D; Dr. D. Pandit, Sci-D; Dr. A.K. Verma, Sci-D; Dr.V.Lakshmanan, Sci-D; Shri. D.Chakrabarty, Sci-D; Shri. G.C Das, Sci-D; Dr. S. Sarkar, Sci-C; Shri. K. Rahul, Sci-B.

CI (RSRS/REC): In-charges of RSRS Koraput; RSRS Jorhat, REC Kamnagar; REC Bhandara; REC Mothabari; REC MP Raj; REC Mamring; REC Agartala; REC Shillong; REC Dimapur; REC Aizwal; REC Imphal;

NSSO: In-charges of SSPC Berhampore; SSPC Raiganj; BSF Banguria; P2 BSF Karnasubarna; SSPC D.B.Pur; SSPC Kalitha; BSF Ambarifalakata

DOT(Seri), W.B.: Shri Rafikul Islam Molla, DI., Murshidabad; Shri Swapan Kr. Mallik, EO., Birbhum; Shri Jamal Sk., EO., Nadia; Shri Santosh Kumar, EO., Malda; Shri Manas

Gupta, EO, U/Dinajpur; Shri Ajoy Ghosh, EO., D/Dinajpur; DoT (Seri) Rep., Jalpaiguri; Shri Subhasis Mandal, EO., Coochbehar; DoT(Seri) Rep, Darjeeling; Shri Asish Chakraborty, AI., Midnapore.

Objectives:

- To identify the disease responsible for crop loss at DOT (Seri), NSSO and farmers' field during seed and commercial crops.
- To suggest effective remedial measures to farmers/farms to prevent /management of the diseases and forewarn the farmers' for ensuing seed and commercial crops.
- To collect the meteorological and crop yield data for analysis.

A. <u>West Bengal</u>:

- *i*) Commercial crops (849 samples) (Fig.19)
- Baisakhi (April): 161 samples collected from 24 villages revealed the following disease incidence: grasserie 1.87% (0.5 2.8%); flacherie 0.5%; muscardine 0.3%; gattine 6.8% (3.9 11.5%) and pebrine 0.4% (0 1.6%).
- 2. **Jaitha (May-June): 68** samples were examined from which 0.07% flacherie and 7.3% grasserie was reported.
- 3. Shravani (July): 77 samples collected from 15 villages revealed on an average 0.83% (0-2.5%) grasserie, 2.66% (0-2%) flacherie and 3.33% (0-5%) gattine.
- 4. **Bhaduri (August): 59** samples collected from 10 villages revealed the following disease incidence: grasserie 7.1% (6.9-7.25), flacherie 1.15% (0-2.3%), gattine 1% (0-2%) and muscardine 0.5% (0-1%).
- 5. Aswina (September): 85 samples collected from 14 villages revealed average incidence of following diseases: 3.55% (3.3-4.1%) grasserie, 4% flacherie and 2.2% (2-2.4%) gattine.
- 6. *Aghrayani (November)*: 254 samples collected from 22 villages revealed average incidence of following diseases: 4.26% (1-5.8%) grasserie, 0.25% (0-1%) muscardine and 0.82% (0-3.3%) gattine.
- 7. *Falguni (February)*: 145 samples collected from 17 villages revealed average incidence of 3.3% grasserie and 0.25% muscardine.

West Bengal (Fig.20)

ii) Seed Crops (3731samples)

3731 samples collected from 91 villages/DoS farms revealed avg. incidences of 1.73 % grasserie, 1.48% flacherie, 0.05% gattine and 1% pebrine.

B. Jharkhand (Fig.21)

An average incidence of 5.85 % grasserie, 2.1 % flacherie, 2.93 % gattine and 0.86% muscardine were reported from samples collected from **50** farmers in 5 commercial crops undertaken during the period.

C. <u>Odisha (Fig.22)</u>

Avg. incidence of 7.49 % grasserie and 8.27 % flacherie was reported from **54** samples collected from rearings conducted in three crops i.e. March'17, Sept-Oct'18 and Oct-Nov'18.

D. <u>NE Region (Fig.23-25)</u>

During the period 329 samples collected from **60** villages of 7 states (Assam, Manipur, Nagaland, Tripura, Mizoram, Meghalaya and Sikkim) of the NE region revealed that:

- ✤ In the Spring crop'17, avg. incidence of Grasserie ranged from 1.1 5.15%; that of flacherie, 0.5 1.7%
- ✤ In *June-July'17 crop*, avg. incidence of 6.77% Grasserie and 2.35 muscardine was reported from crops taken at Agartala and Shillong.
- In the Aug.-Sept. crop taken in Rangpo, Shillong and Imphal , avg. incidence of 4.5% Grasserie, 1.82% flacherie and 0.97% muscardine was recorded.
- In the September crop taken at Agartala, Jorhat & Mangaldoi, avg. incidence of grasserie was 5.31, flacherie 2.1% and muscardine 0.43%
- ✤ In the Sept.-Oct. crop taken at Aizawl and Dimapur, 8.28% grasserie was recorded

Preventive/remedial measures to minimize/control the crop loss due to diseases are regularly being advised to the stakeholders during the time of visit. Meteorological data is also regularly being collected and updated and the same will be correlated with silkworm disease incidence at the time of conclusion of the programme.







Fig.20.Avg. incidences (%) of silkworm diseases during seed crops in West Bengal



Fig. 21. Avg. incidences (%) of silkworm diseases in Jharkhand



Fig. 23. Avg. incidence of silkworm diseases (%) during Spring crop'17 in NE region



Fig. 22. Avg. incidences (%) of silkworm diseases in Odisha



Fig. 24. Avg. incidence of silkworm diseases (%) during June-July crop'17 in NE region



Fig. 25. Avg. incidence of silkworm diseases (%) during Autumn crop'17 in NE region

13.4. ENTOMOLOGY SECTION

13.4.1. BAR(RP) 022: Survey and surveillance of mulberry pests in the eastern and north eastern regions of India. (June, 2016 to May, 2021).

S. Chanda (PI), D. Das, Manjunatha, G. R and incharges of all RSRSs and RECs.

Objectives:

- To generate and widen the database on pest incidence and climatic factors of the different agro-eco zones of the Eastern and North Eastern India.
- To establish correlation between weather factors and pest incidence.
- To develop weather based forecasting models for the major mulberry pests.



Progress: Seasonal occurrence of Major pest (thrips, tukra and Whitefly) in mulberry ecosystem at E & NE region during 2017-18 is given in Table 91.

Table 91. Seasonal occurrence of Major pest (thrips, tukra and Whitefly) in mulberry
ecosystem during 2017-18.

Area	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Range
covered													
Thrips (no./le	af)												
Institute	29.3	13.3	0.00	01.1	00.0	00.0	00.0	00.0	00.0	01.5	37.46	24.54	01.1 - 37.5
Murshidabad	38.0	14.5	37.0	90.7	00.0	00.0	00.0	00.0	00.0	00.0	00.0	81.5	09.7 - 81.5
Malda	24.3	00.6	01.2	01.5	3.35	00.0	00.0	00.0	0.00	0.00	0.49	1.04	00.5 - 24.3
Mamring	01.9	01.6	00.8	0.00	00.0	00.0	0.00	00.0	00.0	0.00	00.0	0.00	00.8 - 01.9
Koraput	04.2	00.9	0.00	00.0	03.8	04.2	04.3	04.7	0.00	0.00	2.85	4.63	00.9 - 04.7
Jorhat	05.6	03.4	02.4	02.0	00.0	00.0	0.00	00.0	00.0	0.00	00.0	00.0	02.4 - 05.5
Tukra (%)													
Institute	00.0	10.0	20.7	0.00	00.0	00.0	0.00	00.0	00.0	0.00	00.0	00.0	10.0 - 20.7
Murshidabad	06.0	08.0	07.4	5.58	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	05.6 - 07.4
Malda	00.0	00.4	0.68	2.25	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.4 - 02.3
Kalimpong (RMB)	00.4	00.3	01.5	3.59	01.8	02.4	05.4	02.40	01.3	00.9	00.8	00.6	0.42-5.40
Mamring	08.1	05.8	1.97	0.73	05.8	00.0	00.0	00.0	00.0	00.0	00.0	00.0	00.7 - 08.1
Koraput	04.9	01.2	00.0	00.0	3.56	05.5	5.69	5.6	00.0	00.0	4.67	06.0	01.3 - 05.7
Jorhat	01.9	05.5	05.7	01.5	00.3	01.6	1.56	00.0	00.0	00.0	00.0	00.0	00.3 - 05.7
Agartala	00.0	0.00	00.0	03.0	00.0	00.0	0.00	00.0	00.0	0.00	00.0	00.0	00.0 - 03.0
Whitefly (no.)	leaf)												
Institute	0.00	0.00	00.0	5.52	06.8	06.3	01.2	02.3	00.0	04.9	04.8	00.0	01.2 - 06.8
Murshidabad	02.3	0.00	0.00	0.00	02.5	02.6	01.0	00.6	0.00	0.00	00.0	00.0	00.6 - 02.6
Malda	00.0	0.00	0.00	01.8	04.6	00.0	02.9	07.4	0.00	0.00	00.0	00.0	01.8 - 07.4
Koraput	04.4	0.00	00.0	0.00	03.13	04.2	04.4	04.5	00.0	0.00	02.9	3.47	02.9 - 04.5
Jorhat	01.3	05.0	50.3	04.0	00.0	01.1	01.1	01.8	00.0	00.0	00.0	05.1	01.1 - 05.3
Imphal	0.00	03.7	03.3	02.2	0.00	00.0	01.0	00.8	00.7	0.00	0.00	0.00	00.7 - 03.7

13.5. EXTENSION DIVISION

13.5.1.B-MOE(P) 043: Seri Model Village. ((Sept., 2017 to Aug., 2020).

D.Das (**PI**), T. Dutta Biswas, Shafi Afroz, S.N. Gogoi, R Kar, S.T. Lepcha, A. Bora, Z. Collin, G.B. Singh, S.Chakraborty, K.C. Bramha, S.B. Dey, R. Luikham, B.K.Basumatary, L.Pachau, and A. Haque.

Objectives:

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

Progress: The Seri Model Village was conducted with 1210 farmers (*Irrigated:* 700 nos; *Rainfed:* 510 nos) covering the eastern and north-eastern region of India. Separate packages for irrigated and rainfed conditions were designated.

Under Irrigated conditions, the leaf yield recorded was 41.43 mt/ha/yr against 37.23 mt/ha/yr (non-SMV farmers), registering a gain of 11.3 %. A total of 1.4 lakhs dfls of Multi x Bi were reared under irrigated conditions during the year. The cocoon yield recorded was 48.7 kg/100 dfls against 44.2 kg, reflecting a gain of 10.6 %.

Under Rainfed conditions, a total of 10000 M x Bi dfls were reared by 50 farmers at Dhenkikote and the results recorded were 38.2 kg against 33.8 kg/100 dfls with a gain of 13.0 %. The leaf yield recorded was 17.4 t/ha/yr against 14.5 t (non-SMV farmers) with gain of 9.3 %. A total of 72750 Bi x Bi dfls were reared by 460 farmers and the leaf yield recorded was 12.42 t/ha/yr against 11.1 t/ha/yr at non-SMV level (Increase: 11.9 %). The cocoon yield was 49.2 kg/100 dfls and the yield range observed was 40.4 - 57.8 kg/100 dfls.

13.5.2.B-MOE(P)044: Adarsh Swachh Resham Gram Programme at Mallickpur-Diara Village. (Apr., 2017 to Mar., 2019)

N. Chandrakanth (**PI**-w.e.f. 01.02.2018), Shafi Afroz (**PI** -upto 31.01.2018), T. Datta Biswas and Debojit Das.

Objectives:

- To create awareness about cleanliness and sanitation among the villagers for behavioral changes about health and hygiene in their homes as well as in the village.
- To improve the socio-economic conditions of the farmers by improved sericulture technologies and practices for their sustainable livelihood development.

Progress: This programme was initiated based on the guidelines and directives of MoT, Govt. of India in line with Swacchta Action Plan (SAP) under *Swacch Bharat Abhiyan*. Mallickpur-Diara village under Khragram block of Murshidabad district of West Bengal was adopted and covered 330 sericulture farmers. Cleanliness drive as well as two sericulture crop, *viz.*, Agrahayani and Falgooni crops were taken for improving the livelihood of the sericulture farmers.

Three hundred and thirty (330) sericulture farmers adopted under this programme were grouped into 30 self-help groups (SHG). Each SHG consists of 11 farmers and has three representatives *viz.*, President, Secretary and Treasurer. Meetings were conducted for each group on regular basis to bring mutual harmony among the members for the welfare of the sericulture community.

Under this programme, mobile phones with GREEN SIM card in collaboration with IFFCO Kisan Sanchar Limited were distributed to all the farmers. Farmers were receiving voice message daily for day-to-day activities of sericulture. Besides, 102 voice messages were sent to the mobiles numbers of 330 farmers of Mallickpur-Diara village through IFFCO kisan. Bank account opening camp was also organized at the village to link all the farmers with the financial service system of India.

Chawki rearing technology was adopted by selecting one farmer in each group and intensive care was taken for distribution of healthy chawki worms to other farmers of the same group. Technologies like hatching on incubation frame, black boxing, use of foam pads, paraffin papers, use of labex, etc., were intensively popularized among the farmers for both Agrahayani and Falgooni crops. The cost for chawki rearing was paid by the institute and transferred through direct benefit transfer (DBT) to the accounts of chawki rearers. Chawki rearing training was also organized at the institute level to the selected members of each group.

During Agrahayani crop, N x (SK6 x SK7) hybrid was reared with nearly 100 percent hatching. The average cocoon yield was 52.00 kg/100dfls ranging from 45-58 kg /100dfls. The single cocoon weight (SCW), single shell weight (SSW) and the shell percent were 1.90 g, 0.33 g and 17.37% respectively. Farmers received highest price ever for the cocoons in this crop. The average rate of cocoon was Rs. 360/- per kg and hence farmers had average gross income of Rs.18720/- during the crop.

During Falgooni crop, Nx(SK6 x SK7) was reared with 90 percent hatching. The average cocoon yield was 47.50 kg/100dfls ranging from 42-55 kg /100dfls. The single cocoon weight (SCW), single shell weight (SSW) and the shell percent were 1.41 g, 0.23 g and 16.21% respectively. Farmers received average gross income of Rs.17100/- for the cocoons in this crop @ of Rs.360/- per kg of cocoons.

During cleanliness drive, two campaigns on 'Swacch Bharat Abhiyan' by covering all the farmers of the village were conducted at Mallickpur on 03.03.2018. The Honorable MP, Mr. Abhijit Mukherjee was leading the campaign as chief guest and accompanied by Dr. Kanika Trivedy, Director, CSR&TI, Berhampore. The campaign was inaugurated by watering to the mulberry plant. Importance of cleanliness and hygiene for healthy life was highlighted by the chief guest. He also motivated to take part in cleanliness drive to keep the surrounding *swachh*. Director delivered her views to see Mallickpur-Diara village as ideal for sericulture as well as cleanliness under 'Adarsh Swachh Resham Gram' programme. Further to strengthen the sericulture in this village, 2 knapsack sprayer along with masks were distributed to each SHG group, and one torch to each of the 330 farmers. All of them took part in clean drive within the village.

13.6. MULBERRY PATHOLOGY SECTION

13.6.1.B-PRP(P) 045: Forewarning of mulberry diseases of Eastern and North Eastern India. (Jan., 2018 to Dec., 2020).

Anil Pappachan (**PI**), G. R. Manjunatha, In-charges of RSRS Kalimpong, RSRS Koraput, RSRS Jorhat, REC Kamnagar, REC Mothabari, REC M.P. Raj, REC Bhandra, REC Agartala, REC Mamring, REC Sille, REC Dimapur, REC Aizawal, REC Imphal and REC Shillong.

Objectives:

- To collect disease incidence and meteorological data of Eastern and North Eastern India.
- To publicize and recommend forewarning system in different locations.
- To develop broad spectrum data base for disease and meteorology of Eastern and North Eastern India.
- To fine tune the existing forecasting models and the existing disease calendar.
- Progress: The programme was initiated at the institute along with other centers. Disease incidence data was collected at weekly interval and meteorological data was recorded on daily basis. In different locations of Eastern and North Eastern India, prevalence of major foliar diseases of mulberry *viz.*, Bacterial Leaf Spot (BLS), *Myrothecium* Leaf Spot (MLS), *Pseudocercospora* Leaf Spot (PLS), Powdery Mildew (PMLD) and Leaf Rust (LR) were recorded in terms of Percent Disease Index (PDI).
- Murshidabad (West Bengal): Incidence of BLS was observed from May to August, with maximum incidence (PDI 17.6) recorded in the month of August. Incidence of MLS was observed from May to November, with maximum incidence (PDI 13.0) recorded during September. PLS and PMLD were observed during November with maximum PDI of 11.6 and 4.77 respectively.
- Malda (West Bengal): Incidence of BLS was observed from June to November with maximum incidence (PDI 3.32) recorded during August. Incidence of MLS was observed from April to February, with maximum incidence (PDI 4.35) recorded during August. PLS incidence was observed from July to November with maximum incidence (PDI 0.78) recorded during November.
- Kalimpong (West Bengal): Incidence of LR was observed from October to November, scoring maximum incidence in October with PDI value of 3.58 and 1.91 respectively. PMLD incidence was observed during October with PDI value of 1.91.

- Koraput (Orissa): Incidence of BLS was observed in June with maximum PDI value of 3.97. Incidence of PLS was observed from September to November, with maximum incidence (PDI 4.67) recorded during October. Incidence of PMLD was observed from October to November, with maximum incidence (PDI 4.72) recorded during November. Incidence of LR was observed from April to October, with a maximum PDI of 4.88 recorded during the month of October.
- Maheshpur Raj (Jharkhand): Incidence of BLS was observed from June to September, with maximum incidence (PDI 4.41) recorded during September. MLS and PLS incidences were observed during July, with PDI value of 4.51 and 4.10 respectively.
- > Jorhat (Assam): During October LR was observed with a PDI value of 2.72.
- Agartala (Tripura): Incidence of BLS was observed from August to October, with maximum incidence (PDI 1.41) recorded during October while PMLD was observed during the month of October with PDI value of 1.40.
- Mamring (Sikkim): PMLD disease was observed during July to September with maximum incidence (PDI 1.11) recorded during September.
- Mangaldoi (Assam): BLS and LR incidences were observed during the month of October with maximum PDI value of 3.2 and 2.5 respectively.
- Aizawal (Mizoram): Incidence of PMLD disease was observed during April to February with maximum incidence (PDI 3.39) recorded during October.
- Imphal (Manipur): Incidence of PMLD was observed during the months of October and January with maximum PDI value of 1.60, while LR was recorded during August, with a PDI of 0.41
- Shillong (Meghalaya): Incidences of BLS and PMLD were observed from August to October, with maximum incidence recorded (PDI 2.6) during August, while LR was observed during October with a maximum PDI of 2.0

13.6. RSRS, KALIMPONG

13.6.1. B-KPG (P) 017: Maintenance of bivoltine silkworm germplasm. (Apr., 2015 to Mar., 2020).

R. Kar (**PI**).

- **Objective:** To maintain the bivoltine silkworm breeds true to their original racial characters and to study their qualitative and quantitative traits.
- **Progress:** A total of 39 Bivoltine breeds are being maintained in the Bivoltine Germplasm Bank as Stock lot at RSRS Kalimpong. Rearing of the same was

conducted during Spring crop (April-May), 2017. The rearing performances of the breeds are presented below in Table 92.

Table 92. Rearing Performance of Bivoltine Silkworm Germplasm Breeds in spring,2017 crop.

#	Breed	Fec.(No.)	ERR		SCW (g)	SSW(g)	Shell (%)
			No.	Wt. (kg)			. ,
1.	B. Con. 1	541	8150	14.02	1.598	0.292	18.27
2.	B. Con. 4	512	8083	13.22	1.538	0.279	18.14
3	BHR1	517	6317	9.05	1.570	0.267	17.01
4	BHR 2	512	5850	6.52	1.599	0.294	18.39
5	BHR 3	526	5133	8.45	1.531	0.285	18.62
6	BL1	457	5417	10.33	1.558	0.279	17.91
7	BP (Ch)	510	7583	10.52	1.217	0.190	15.61
8	BP (BI)	443	7383	10.12	1.202	0.183	15.22
9	CSR 5	528	4467	5.82	1.409	0.245	17.39
10	CSR 18	487	4550	6.22	1.464	0.264	18.03
11	CSR 19	519	4817	7.83	1.433	0.263	18.35
12	CSR 2	452	4750	6.47	1.347	0.244	18.11
13	CSR 6	495	4800	6.05	1.434	0.250	17.43
14	CSR 26	515	4500	5.90	1.449	0.266	18.36
15	CSR 51	509	3417	4.75	1.463	0.275	18.80
16	CSR 52	498	5167	8.25	1.427	0.258	18.08
17	CSR 53	503	3433	4.65	1.504	0.266	17.69
18	Changnang	508	4533	6.23	1.514	0.270	17.83
19	D4	513	6300	10.17	1.496	0.272	18.18
20	D6M	541	6533	9.67	1.532	0.273	17.82
21	D6(P)	515	7233	10.80	1.599	0.290	18.14
22	JD 6	528	5417	8.77	1.608	0.297	18.47
23	J 122	519	4733	6.733	1.599	0.283	17.70
24	KPG-A	538	6433	9.40	1.578	0.287	18.19
25	KPG- B	535	5583	7.50	1.455	0.260	17.87
26	KPG-7	529	4683	6.63	1.497	0.272	18.17
27	MC1	536	5433	7.50	1.389	0.251	18.07
28	MC2	520	4733	6.27	1.592	0.283	17.78
29	MJ 1	535	5067	7.35	1.502	0.268	17.84
30	MJ 2	522	4917	6.77	1.493	0.265	17.75
31	NB4D2	513	8033	12.50	1.507	0.283	18.78
32	NB 18	537	5650	7.93	1.589	0.297	18.69
33	P5	524	5400	8.87	1.494	0.270	18.07
34	Pam 105	485	4700	6.13	1.559	0.272	17.45
35	SF19	539	5467	9.13	1.600	0.289	18.06
36	SH-6	527	4133	6.47	1.531	0.269	17.57
37	SK4 (II)	526	5433	9.00	1.550	0.291	18.77
38	SK6	513	7667	12.23	1.603	0.290	18.09
39	SK7	536	8250	11.87	1.488	0.268	18.01

13.6. RSRS, JORHAT

13.6.1. B-JRH(PRP)-046: Studies on mulberry germplasm in agro-climatic condition in North East State, Assam. (Sept., 2017 to Aug., 2020).

Mina Pamegham (PI).

Objective: To study and maintain mulberry germplasm in agro-climatic conditions of North Eastern states.

Progress: All the plants (03 accessions) including new collections are being maintained following cultural operations under germplasm plot.

Expt. 01: Studies on growth and leaf yield of mulberry genetic resources.

20 new mulberry accessions were collected from CSGRC, Hosur (Table 93) during Sept., 2017 and raised in nursery of RSRS, Jorhat. Among the accessions high survival percentage was recorded in MI-0149 (100%) followed by MI-0110 (93%) and low was recorded in MI-0072(13.33%) during the year.

#	Accession No.	National Acc. No.	Survival (%)
1	MI-0024	IC-313 685	40.00
2	MI-0038	IC-313 981	32.50
3	MI-0069	IC-313 712	64.29
4	MI-0072	IC-313 715	13.33
5	MI-0101	IC-313 829	76.66
6	MI-0110	IC-313 735	93.33
7	MI-0350		20.00
8	MI-0170	IC-313784	73.33
9	MI-0206	IC-313 790	46.67
10	MI-0209	IC-313 962	46.67
11	MI-0341	IC-314112	57.50
12	MI-0345	IC-314115	80.00
13	MI-0361	IC-314130	66.67
14	MI-0377	IC-314131	73.33
15	MI-0395	IC-314140	66.67
16	MI-0403	IC-314143	80.00
17	ME-0142	EC-493869	90.00
18	ME-0149	EC- 493876	100.00
19	ME-0188	EC-493915	40.00
20	ME-0208	EC-493935	25.00

 Table 93.
 Studies on survival percentage of the accessions.

14. TRAINING PROGRAMMES CONDUCTED 14. A.MAIN INSTITUTE

14. A.1. STRUCTURED TRAINING COURSE

A.1. Post Graduate Diploma in Sericulture (Mulberry): Duration: 15 months. Scientists associated: Chandana Maji, Sci-D and Sukhabrata Sarker, Sci-C.

Objective: To generate a steady stream of professionally competent Human Resources from the fresh candidates / deputed by different state Governments/ NGOs in both pre and post cocoon sectors for meeting the manpower requirement by the sericulture industries at various levels.

A batch comprising of 13 students of the session 2016-17 have successfully completed PGDS course by 30th September, 2017 and the next batch of 20 students of the session 2017-18 are undergoing training. The course is affiliated under the University of Kalyani, Nadia.

#	Sponsoring Agencies	gencies No. of candidates		
		completed the course by 30.09.2017	Started the course by 01.07.2017	
1	Govt. of Manipur	05	09	
2	Govt. of Nagaland	03	-	
3	Govt. of Mizoram	02	02	
4	Govt. of Arunachal Pradesh	03	05	
5	Telengana	-	01	
6	Orissa	-	01	
7	Jammu & Kashmir	-	02	
	Total:	13	20	

Details of Post Graduate Diploma in Sericulture (Mulberry):



PGDS Trainee Mulberry study tour

PGDS Trainee Non Mulberry study tour

PGDS trainee at CTR&TI, Ranchi

14.A.2. NON-STRUCTURED TRAINING COURSE

14.A.2.1. Farmers Skill Training Programme:

Duration: 5 to 10 days.

Scientists associated: Chandana Maji, Sci-D and S. Sarker, Sci-C.

Objective: To upgrade the knowledge of sericulture farmers through theoretical and practical training for overall achievement in increase of their income levels from sericulture.

A total of 384 sericultural farmers were trained under this programme.

Details of the farmers training

Name of the course	Duration (Days)	Persons trained (No.)
Chawki Silkworm Rearing	10	264
Late Age Silkworm Rearing	10	71
Mulberry cultivation	05	18
Integrated disease & pest management	05	31
Total:	-	384



Farmers feeding the Chawki worms



Farmers are attending classes on Mulberry Sericulture



Farmers on theory class

14.A.2.2. Post Cocoon Technology:

Duration: 3 days

Scientists associated: Chandana Maji, Sci-D and S. Sarkar, Sci-C.

Objective: To impart practical training to the stakeholders of Murshidabad district about the latest technologies for the benefit of the stakeholders.

A total of 58 farmers were trained under this programme.

14.A.2.3. Technology Orientation Programme:

Duration: 3 days

Scientists associated: Chandana Maji, Sci-D and S. Sarkar, Sci-C.

Objective: To upgrade the knowledge of officers / officials both CSB and DoS in respect to technologies developed by this Institute for its effective translation in the farmers' field of their respective states for promotion of enterprise to achieve the target.

A total of 184 officers and staff of different sister units under CSB were trained in this training programme.

14.A.2.4. Management Development Programme: Duration: 1 day Scientists associated: Chandana Maji, Sci-D and S. Sarker, Sci-C. **Objective:** To orient and skill updating the knowledge of officers / officials both NGOs and Bank with reference to need based technologies recently developed by this Institute for its effective translation in the field for promotion of enterprise to achieve the target.

A total of 103 officers and staff of different sister units under CSB were trained in this training programme.

#	Duration (Days)	Sponsoring authority	Persons trained
1	1	Bank officials	32
2	1	NGOs	33
3	1	Bank officials	38
	Tot	103	



Bank officials attending class on MDP



on 05.01.18



Trainee expressing his views during validation

14.A.2.5. Need Based Training Progm. conducted on request of different agencies

#	Course	Duration	Sponsoring	Persons	Objective			
4	A	(Days)			To import topicing on latent tophysical			
1	Awareness Training	6-10	DoS, Binar	131	To impart training on latest technologies			
	Programme for				developed by the Institute to the officers & officials			
	Jeevika Bihar				of DoS, Bihar.			
2	Awareness Training	05	DoS, UP	09	To impart basic training on different aspects of			
	Prog. for farmers of				sericulture and technologies developed by this			
	Uttar Pradesh				Institute for the region.			
3	Awareness Training	1 day	DoS, W.B.	101	To impart basic knowledge on sericulture and for			
	Programme for W.B.	-			exposure on latest technologies developed by the			
	farmer				Institute to the farmers and officials of concerned			
					state.			
	Total:	-	-	847				



Interaction with JEEVIKA Farmers of Bihar



Farmers are attending Theory class



14.A.2.6. Need based training programme conducted on the request of different agencies:

Scientists associated: Chandana Maji, Sci-D and S. Sarker, Sci-C.

#	Course	Duration	Sponsoring	Persons	Objective
		(Days)	authority	trained	
1	Exposure visit under Technology awareness programme	2-3	DoS, Assam, Bihar, Jharkhand , Meghalaya, W.B. & students	622	To impart basic knowledge on sericulture and for exposure on latest technologies developed by the Institute to the farmers and officials of concerned state.
2	Intensive Training	15-30	CSB, DoS staff & students	113	To impart basic training on different aspects of sericulture and techno-logies developed by this Institute for the region.
3	Seri Resource Centre	1	DoS W.B.	1235	To upgrade the knowledge of the farmers through adopted sericulture lead farmers
			Total =	1970	

Details of Adhoc training programmes conducted

Visit of students from universities/colleges/schools/organizations and farmers for an exposure to mulberry sericulture

A total of 141 students along with escorts were exposed to modern technologies concerning sericulture activities during 2017-18 at this Institute.

#	Date	Sponsored by	Persons (No.)
1.	03.04.17 to 07.04.17	CTR&TI, Ranchi	19
2.	18.04.2017	Girls College, Berhampore, W.B.	73
3.	30.05.2017	Girls College, Berhampore, W.B.	14
4.	01.12.2017	South City School, Maharashtra	23
5.	08.03.2018	Senior citizen , local	15
		Total=	141

14.B. NESTED UNIT

14.B.1.RSRS,KALIMPONG, WEST BENGAL

14.B.1.1. Trainers Training Programme (TTP):

One day TTP was conducted by RSRS, CSB, Kalimpong each at its premises on 31.01.2018 and at SDF, Barbat, DoT(Seri), Kalimpong, WB. The trainees were imparted training with different aspects of soil sampling, nursery technique, rearing of bivoltine silkworm, especially precautionary measures of silkworm diseases, chawki worms, bed spacing etc.

Name of the Course	Date	Participants (Nos.)
Trainers Training Programme	31.01.2018 & 17.03.2018	19 & 22

14.B.1.2. Farmers Training Programme (FTP):

RSRS, CSB, Kalimpong conducted one day FTP each at Dalapchand village on 06.11.2017, at Echhey village on 07.11.2017, at Yogda Sangsay village on

23.02.2018, at SDF, Gitdabling, DoT (Seri), on 06.03.2018 and Sangsay-Mahakaldara village on 13.03.2018 with a view to enhance the knowledge level of the seri-farmers of Kalimpong area on different aspects of silkworm rearing and mulberry plantation.

Name of the Course	Date	Participants (Nos.)
Farmers Training	06.11.2017 / 07.11.2017 / 23.02.2018	22 / 23 / 17
Programme	/ 06.03.2018 / 13.03.2018	/ 25 / 14
Total	05 nos.	101

14.B.2.RSRS,KORAPUT

14.B.2.1. Trainers Training Programme (TTP):

A total of 17 technical personnel were trained from DOS, Odisha from the districts of Gajapati and Koraput with two trainers training programmes.

#	Place of training	Date	No of trainee s	Topics discussed
1	ADS office, Chandragiri	7.11.2017	8	 Soil Testing & its reclamation. Integrated Package of Practices for Mulberry cultivation Disinfectants and disinfection procedure for a successful
2	RSRS Koraput	16.03.2018	9	 Distinctions and distinction procedure for a succe rearing, and New Technologies of Silkworm Rearing & managem Extension management

Table 96. Batch wise Trainers training programme:

14.B.2.2. Farmers' Training Programme (FTP):

A total of 92 farmers were trained in **five** Farmers Training Programmes from the states Odisha and Chhatisgarh.

Topics Discussed # Date No of farmers Area 1 Lamtaput 16.09.17 15 Mulberry cultivation 2 10.08.17 Kashipur 15 Silkworm rearing management 3 Phulbani, Kalilgira 18.10.17 24 Disinfection solution preparation and • 4 Maakdi (C.G.) 17.11.17 19 disinfection procedure 5 Bhawanipatna 23.02.17 19 Total 92

Batch wise Farmers training programme:

14.B.2.RSRS, JORHAT

14.B.2.1. Trainer's Training programme:

Under Human Resources Development Programme, 5 days training programme was conducted at RSRS, Jorhat during the year. A total of 10 nos. of DOS officials of Jorhat and Golaghat district were trained in various aspects like Mulberry plantation,

silkworm rearing, Chawki rearing, disinfection of rearing room, black boxing, disease & pest management etc. The detailed is presented below:

Sponsoring Agency	Target	April to Sept.	Oct. to March	Achievement
CSB	2		2	2
			(10 officials)	(10 Officials)

14.B.2.2. Farmers Training Programme:

Under Human Resources Development Programme, Farmers training programme was conducted at RSRS, Jorhat and its 7 nested unit during the year. A total of 2328 nos. of mulberry farmers of N.E. states were trained in various aspects like Mulberry plantation, silkworm rearing, Chawki rearing, disinfection of rearing room, black boxing, disease & pest management etc. The detailed is presented below:

Unit	Target	Achievement/ Farmers
RSRS, Jorhat	05programme	5 (183)
REC, Agartala	10 programme	10 (250)
REC, Aizawl	10 programme	10 (357)
REC, Dimapur	10 programme	10 (350)
REC, Imphal	10 programme	10 (390)
REC, Shillong	10 programme	10 (325)
REC, Mangaldoi	10 programme	10 (362)
REC, Sille	5 programme	5 (111)
Total	70	70 (2328)

14.C. TRAINING CUM DEMO SESSION

Training cum demo session on **usage of SYSTAT-13 software for statistical analysis** was organized under the ongoing project MTS-3599, PMCE division demonstrated by Shri Puneet, Asst. Manager, Starcom infotech, Bangalore. A total of 24 Scientists attended and interacted actively with their data-set for specific statistical analysis.

14.D. TRAINING PROGRAMME PARTICIPATED

- Dr. Manjunatha, G.R., Scientist-B participated in National Workshop cum Training Programme on "Statistical Tool for Research Data Analysis (Series II)" organized by SASAA in collaboration with Dept. of Agril. Statistics, BCKV, West Bengal [02 Weeks *w.e.f.* 29.05.2017].
- Mr. K. Rahul, Scientist-B deputed to Indian Institute of Science Education and Research (IISER), Kolkata for the **determination of quality control parameters** of the new room disinfectant [Ghar Sodhon] and bed disinfectant [Sericillin] using GC-MS [dt.13-16.11.2017].
- Dr. V. Vijay, Scientist-B, deputed to BCKV university for arsenic analysis in soil, leaf and silkworm samples using FIAS-HG-AAS (<u>Hydride Generation</u> <u>Atomic Absorption Spectroscopy</u>) [dt.18-27.12.2018]

15. Important Delegation leaded or participated:

On the eve of **75th Foundation Day** [Platinum Jubilee] of CSR&TI, Berhampore held on 15 & 16.10.2017, the dignitaries participated at the occasion were the Hon'ble Chairman of the Central Silk Board, Mr. K. M. Hanumantharayappa, Chief guest Dr. Sanjeev Chopra, IAS, Additional Chief Secretary, Dept. of Agriculture, Govt. of West Bengal, Smt. Madhumita Chowdhury, IAS, Commissioner of Textiles & Sericulture, Govt. of W.B, Dr. P. Ulganathan, IAS, District Magistrate, Murshidabad, W.B, Dr. S. Nirmal Kumar, Former Director of this institute along with Honorable Director Dr. Kanika Trivedy, CSR&TI, Berhampore and her team.



16. RESEARCH PUBLICATIONS

#	Particulars	Total
1.	Research papers:	
	A. International journals	4
	B. National journals	12
2.	Popular articles	8
3.	Book/ Book Chapter	9
4.	Manual	9
5.	Booklet	13
6.	Pamphlets	42
7.	Magazine	3

I. Research papers: 16 Nos.

International: 4 Nos.

- Hossain, Z., Chakraborty, S., Gupta, S. K., Saha, A. K. and Bindroo, B. B. (2017). Silkworm disease incidence trends during the years 1992–2011 in the Murshidabad district of West Bengal, India. *Int. J. of Tropical Insect Science*. 37(4): 259-270. doi:10.1017/S1742758417000182.
- Kar, R., Ram, R. L., Ghosh, M. K. and Trivedi, K. (2017). Response of mulberry (Morus alba L.) to foliar supplementation of nutrient-composite. Int. J. of Agri. Innovations and Res., 6(3): 582-586.
- 3. Makwana, P., Pradeep, A.R., Hungund, S.P., Sagar, C., Ponnuvel, K.M., Awasthi, A.K. and Trivedy, K. (2017). Oxidative stress and cytotoxicity elicited lipid peroxidation in hemocytes of *Bombyx mori* larva infested with dipteran parasitoid, *Exorista bombycis*. *Acta Parasitologica*, 62(4): DOI: 10.1515/ap-2017-00.
- Suresh, K., Ghosh, M.K., Banerjee, R., Chakravarty, D. and Trivedy, K. (2018). Multivariate analysis of indigenous and exotic mulberry (*Morus* Spp.) germplasm for identifying diverse genotypes under humid subtropical region. *Int. J. Pure App. Biosci.* 6(1): 618-627.

National: 12Nos.

- Chaudhuri (nee Mukhopadhyay), M., Nirmal Kumar S. and Trivedy, Kanika (2017). Application of growing degree days as model driver in sericulture management. *Indian Biologist*, 48 (2): 11-17.
- Kar, R., Vrajan, V., Ghosh, M. K., Dutta, S. K., & Trivedy, K. (2018). Prediction of nitrogen availability based on soil organic carbon in commercial mulberry vegetation of Eastern India. *JSSEM*, 9(3): 30-34.
- Kiran Kumar R. Patil, Chinnappa, B., Ganesh Prasad, Vishwajith K.P. and Manjunatha, G. R. (2017). Economic performance of contract broiler farming. *Indian Journal of Poultry Science*, 52(2): 217-22.

- 4. Kiran Kumar, R. P., Adivappar, N., Chinnappa, B and Manjunatha, G.R. (2017). Economic analysis of commercial tomato nurseries. *Journal of Crop and Weed*, 13(1): 137-141.
- 5. Manjunatha, G.R., Majumder, A. and Patil, S.G. (2017). Generalised neighbour designs in circular blocks with group-divisible association scheme for correlated observations. *J. of the Indian Society of Agricultural Statistics*. 71(1) 39 -52.
- Monir, S., Mondal, N.C., Pappachan, A. and Dutta, S.K. (2017). Study on feeding of powdery mildew infected mulberry leaves in silkworm rearing and its bioassay. *Bioscience Discovery*, 8(1): 20-23.
- Pappachan, A., Bariampan, L. and Trivedy, K. (2018). Effect of application of *Ascophyllum nodosum* extracts on the yield and quality of mulberry leaves. *Bioscience Discovery*, 8(2): 235-240.
- 8. Patil, K. R., Adivappar, N., Chinnappa, B. and Manjunatha, G.R., (2017). Economic analysis of commercial tomato nurseries. *Journal of Crop and Weed*, 13(1): 137-141.
- 9. Pavithra, N. L., Ashalatha, K. V. and Manjunatha, G. R. (2018). Estimation of change in food grain production patterns in Karnataka State-Markov chain approach. *Journal of Pharmacognosy and Phytochemistry*, SP1: 955-957.
- 10. Rahul, K., Hossain, Z., Chandrakanth, N. and Trivedy, K. (2017). Studies on the effect of *Bm*NPV stress on the larval and cocoon characters of silkworm, *Bombyx mori* L. *J. of Res. in Science, Technology, Engineering and Management.* 4(2).
- 11. Suresh, K., S. K. Jalaja, R. Banerjee and K. Trivedy. (2017). Genetic variability, correlation and path analysis of physiological and yield attributes in mulberry (*Morus spp.*). *Journal of Crop and Weed*, 13(1): 28-33.
- Vasanthi, C., Patil, K. K. R., Manjunatha, G.R., and Chinnappa, B. (2017). Spatiotemporal integration of tomato markets in Karnataka state: An econometric analysis. *Journal of Crop and Weed*, 13(2): 45-51.

II. Popular articles: 8 Nos.

- रंजित कर, देबजीत दास एवं कणिका त्रिवेदी (2017). कलिमपोंग के पर्वतीय क्षेत्रों में शहतूत पोषण के लिए मदा जांच पर आधारित प्रौदयौगिकियाँ, Indian Silk, 8/old 56 (5-7): 46-47.
- 2. Z. Hossain and K. Rahul (2017). *Polur Procholito Rog Nibarone Proyojoniyo Ritubhittik Satarkata*. Resham Krishi Barta (in Bengali). No. **2**.
- 3. Shubhra Chanda and Dibyendu Sarkar (2017). Unmukta palupalan ghar -Resham Krishi Barta, No.1 (2).
- 4. Shubhra Chanda, Dibyendu Sarkar and Subal Kumar Paul (2017). Tut patay shuapokar akraman o pratikarer upay, Resham Krishi Barta, No. 2 (1).

- 5. N. Chandrakanth, A.K. Verma & V. Lakshmanan, (2017) Plastic chandrakir baiwahar awam ear nirbijan padhhati (In Bengali) Resham Krishi Barta, No.2 (3), p.2.
- 6. Resham gutir ansh chadanor (defloshing) sahaj upay (2017). V. Lakshmanan, N. Chandrakanth, & A.K. Verma (In Bengali) Resham Krishi Barta, No.2 (3), p.1.
- 7. Diapause inhibitor breed- A new finding (2017). A.K. Verma, G.K. Chattopadhyay & N.B.Kar, News & Views, 11(1):p.3.
- Kiran Kumar, R. P., Manjunatha, G.R. and Chandrakanth, M.G. 2017.Food price volatility. *Maharashtra Economic Development Council*, Monthly Economic digest. 10(9): 20-23.

III. Book/ Book Chapter: 9 Nos.

- 1. Annual Research and Administrative Report 2016-17, CSR&TI, Berhampore.
- A Practical Handbook on Silkworm Diseases & Pests (2017-18: for PGDS Semester-I)). Z. Hossain, K. Rahul and S.Chanda. CSR&TI Berhampore, p.74
- 3. Technology Descriptor entitled, "Kalimpong Pahari Ketroko Nimti Resham Utpadan Prawidhiki Bibaran" –RSRS, Kalimpong, WB.
- 4. Handbook on Mulberry Cultivation and Silkworm Rearing REC, Aizawl, Mizoram.
- 5. Mulberry Silkworm diseases and Pest Management -A.Borah, S.N.Gogoi, Kanika Trivedy.
- 6. Disinfection and hygiene in Silkworm Rearing -A.Borah, S.N.Gogoi, Kanika Trivedy.
- 7. A Hand Book on Mulberry Cultivation and Silkworm Rearing (2018). L. Pachau, REC, Aizawl, Mizoram. (in Mizo Language).
- 8. Unnata Prajukti- Nunikheti Aaru Pat Palu Palan (2017). S.N.Gogoi, Mina Pamehgam, U.C. Boruah, and K.Trivedy. (in Assamese language).
- 9. Technology Book on Sericulture for Tripura State (2018). G.B. Singh,

IV. Manual: 9 Nos.

- 1. Manual for Extension Communication Programme [ECP]- Shafi Afroz, T.Datta Biswas, D. Das, N.B.Kar and Kanika Trivedy.
- Ka Rukom Thung Dieng Son Lyngdkhur Bad Ka Jing Ri Khniang Rusom Ka Ba Bha-Collin Z. Renthlei, L.Dkhar, M. Lasoa, A. Kharpran, R. Synjri, S.n.Gogoi and Kanika Trivedy.
- 3. Kalimpong Pahari Ketroko Nimti Resham Utpadan Prawidhiki Bibaran –R. Kar, RSRS, Kalimpong.
- 4. Unnata Prajukti-Nunikheti Aru Pat Palu Palan S.N.Gogoi, M. Pamegom, U.C.Barua and Kanika Trivedy.
- 5. Bivoltine Silkworm Rearing Manual -S.T.Lepcha and Kanika Trivedy.
- 6. Sericulture Technology Manual C.Z. Renthlei.



- 7. Manual of Bivoltine silkworm rearing L.Somen Singh, Reeta Luikhum, S.N. Gogoi, and K. Trivedy.
- 8. Techniques for mulberry cultivation and management in Meghalaya- Collin Z. Renthlei,.
- 9. Silkworms rearing techniques in Meghalaya- Collin Z.Renthlei,.

V. Booklets: 13 Nos.

- 1. Tunt Resham chash -K. C. Brahma.
- 2. Mulberry Silk -G.B.Singh, Nirmal Kumar and S. Gangopadhyay.
- 3. Bivoltine Longthok Til Yokpagi maong -L.S.Singh, R.Luikham, S.N.Gogoi and Kanika Trivedy.
- 4. Manipurada Kabrangchak Pambi Thabgi Amdi Langthok Til Yokpagi Shamlappa chatn kanglonasing -L.S.Singh, R.Luikham, S.Chattopadhyay and Kanika Trivedy.
- 5. Chawki Tunt Chash O Palu Palaner Sathikm Paddhati-T.Datta Biswas, D.Chakraborty, R.Mahesh, A.Sahoo and Kanika Trivedy.
- 6. Appropriate Technology for Chawki Mulberry Cultivation and Silkworm rearing -T.Dutta Biswas, D.Chakraborty, R.Mahesh, A.Sahoo and K. Trivedy.
- 7. Atyadhik Bivoltine Resham Kshetiko Pragati Ebang Yojana-S.T.Lepcha, B.Silal, C.Bhutia and B. Khabash.
- 8. Sikkim Pahari Kshetra Adharit Resham Keshi Bare Takniki Bibaran S.T.Lepcha, B.Silal, C.Bhutia, B. Khabash and Kanika Trivedy.
- 9. Young Age Silkworm Rearing -A.Borah, S.N.Gogoi and Kanika Trivedy.
- 10. Mulberry Cultivation Practices -A.Borah, S.N.Gogoi and Kanika Trivedy.
- 11. Incubation and Black Boxing of Silkworm Egg -A.Borah, S.N.Gogoi and Kanika Trivedy.
- 12. Silkworm Disease and Pest Management -S.N.Gogoi, U.C.Barua and M. Pamegam.
- 13. Nuni Khetir Pratipalon S.N. Gogoi and B. Basumatary.

VI. Pamplets: 42 Nos.

Hindi: 4 Nos.

- 1. Chawki Kitpalan G.S.Singh.
- 2. Scymnus pallidicolli ke bahu-gunan ki taknik churni matkun ka ek parbhakshmi (2018).- S. Chanda, Shafi Afroz, D. Sarkar and S. K. Paul.
- 3. Resham Kitpalan Men Roganunashak ka mahatwa- M.Alam, G.S.Singh and R.Kumar.
- 4. Resham KitpalanKe Pramukh Rog Ebang Unka Prabandhan-G.S.Singh.

Bengali: 6 Nos.

1. Chawki tut chash O polupalon er sathik paddhwati (2018).T. Dutta Biswas, D. Chakravarty, R. Mahesh, A. Sahu and K. Trivedy.

- 2. Porishodhon O Porishkar Porichhonnota (2018). Z. Hossain and K. Rahul.
- 3. Gabesanagare mealybug nashkari bandhupoka Scymnus pallidicolli- er bansha briddhi karar prayukti (2018) S. Chanda, D. Sarkar and S. K. Paul.
- 4. Mites- Tunt Gacher ekti Kshatikarak Makar -D.Das, T. Datta Biswas and S. Afroz.
- 5. Bakser Alga(Luj) Dim Jharar Paddhati T.Datta Biswas, D.Das and S.Afroz.
- Ujjal sambhawanapurn sankar prajatiir natun japani polu, B.Con.1 x B.Con.4 (2018). A.K.Verma, G.K. Chattopadhyay and N.B. Kar.

English: 3 Nos.

- 1. A comprehensive guide to use plastic mountages: Chandrike folding apparatus A easy way to fold plastic mountages (2017). K. Trivedy, N. Chandrakanth, A.K. Verma and V. Lakshmanan.
- An innovative tool for cocoon deflossing A boon to Bivoltine Basic Seed Farms in race maintenance (2017). V. Lakshmanan, N. Chandrakanth, A.K. Verma and Kanika Trivedy.
- 3. Tr-23: New mulberry variety for subtropical hills of Eastern & North-Eastern India. (2017). K. Suresh, D. Chakravarty, A. Pappachan and K. Trivedy.

Vernacular languages: 29 Nos.

- 1. Chawki Garden Maintenance G.B. Singh, REC, Agartala.
- 2. Chalukiya pat palupalan S.N. Gogoi, M.Pamehgam and U.C. Boruah.
- 3. Chawki Tunt Baganer Paricharja- Kanika Trivedy, G.B.Singh, H.Nom, S.Gangopadhyay.
- Kabrangchak Pambida Taba Tilsing amsung Masibu Unakthoknaba Upay
 L.S.Singh, R.Luikham, S.N.Gogoi, Kanika Trivedy
- 5. Kalimpong, Darjeeling ani Sikkimka Pahari Khetrama Kalam Dwara Swasth Kimbuko Birubao mane Paddhatio-R. Kar.
- 6. Kalimpong ko Parbatiya Khetrama Kimbuko Uchit Poshonko Nimitt Matoko Janchma Adharit N.P.K Prayogoko Pradyogiki -R. Kar.
- 7. Kilad Jingiada Naki Khniang Jingpang Jong U Muga Bad Ki Jingpang Dieng Ba U Shaog-Collin Z.Renthlei, L.Nongrang, D.Kharmawlong and K. Trivedy
- Ka Jing Pynbonkam La Ki mJaka Pynsop Khniang Ba Lah Shna Da Ka Plastik Ne Ki Plastik Sop Khniang-Collin Z. Renthlei, L.Nongrang, D. Kharmawlong and K. Trivedy.
- 9. Manipurda Kabrangchak Pambee Thabgee Aomdee Longthuk Toul Yukpagi Samlapa Satna Kanglunsing L.Somen Singh, Reeta Luikhum, S. Chaterjee and K.Trivedy.
- 10. Mulberry plantation procedure and its maintenance- G.B. Singh, REC, Agartala.
- 11. Mounting of Silkworm G.B. Singh, REC, Agartala.
- 12. Nuni ketir pratipalan B.K.Basumatari, S.N.Gogoi and Kanika Trivedy.

- 13. Nuni Gosor Nursarir Koukhal S.N. Gogoi and B. K. Basumatary.
- 14. Nuni Khetit Milibag Aru Eyar Protikar S.N. Gogoi and B.K.Basumatary.
- 15. Nuni Khetit Boga Makhir Pradurvab Aru Eyar Pratikar S.N. Gogoi and B.K. Basumatary.
- Pat Palur Rog Aru Niyantran -S.N.Gogoi, M. Pamegom, U.C.Barua Tripuray Resham Silpe Prajuktir Byabahar O Nirdeshika Samuha – K. Trivedy, G.B.Singh, H. Nam and S. Gangopadhyay.
- 17. Pahari Ilakama Safal Resham Kira Palanka Nimitt Kehi Pramukh Bindu Haru -R. Kar
- 18. Plastika Saba Mohum Chandrika Seejinnabagee Samlapna Takapa Warul -L.S.Singh, R.Luikham, S.N.Gogoi and K. Trivedy.
- 19. Paka Pokar Chandrakite Deoyar Paddhati Kanika Trivedy, G.B.Singh, H. Nom and S.Gangopadhyay.
- 20. Resham Kira Palan Masano Abasthako Kira Chawki Palanoko Mahatwa -R.Kar
- 21. Resham Kimbu Ksheti Ani Resham Kira Palan Sathai Bivinna Kimbu Resham Kirako Prajati Haru Bare Kehi Jankari -S.T.Lepcha.
- 22. Rotary mountage -Collin Z.Renthlei, L.Nongrang, D.Kharmawlong and Kanika Trivedy.
- 23. Sahatunt Rog Purba Suchana Sarani -K.C. Bramha and S.K. Misro.
- 24. Silkworm Disease and Pest Management S.N. Gogoi and B.K. Basumatary.
- 25. Technique to Increasing Leaf Productivity G.B. Singh.
- 26. Tunt Gach Ropaner Paddhati O Rakshanabekshan- Kanika Trivedy, G.B. Singh, H.Nom and S.Gangopadhyay.
- 27. Tunt Patar Falan Briddhite Unnata Prajukti-Kanika Trivedy, G.B.Singh, H.Nom and S.Gangopadhyay.
- 28. Unnata Nuni khetir Paddhati -S.N.Gogoi, M. Pamegam and U.C.Barua.
- 29. U Tiar Weng Ksai Na Ki Sop Khniang Ba Shna Da U Nar Rod Collin Z.Renthlei, L.Nongrang, D.Kharmawlong and K.Trivedy.

VII. Magazine: 3 Nos.

- 1. News & Views –Half yearly (in English)
- 2. Resham Krishi Barta- Quarterly (in Bengali)
- 3. Resham Krishi Varta- Quarterly (in Hindi)

17. PAPER PRESENTED IN CONFERENCES/MEETINGS/SEMINARS /SYMPOSIA etc.

International: 4 Nos.

VIII International Conference on wild Silk moths held during 22^{nd} to 24^{th} January, 2018 at Guwahati, Assam.

- 1. Afroz, S., Manjunath, G.R., Biswas, T.D., Das, D. and Trivedy, K. (2018). Dynamic roles of extension workers for improvement of sericulture industry in India. (Abs.) *p.130*.
- Chakrabarty, S., Manna, B., Saha, A.K., Choudhury, R., Barua, N.B., Choudhury, B. and Trivedy, K. (2018). Studies on ultra-structure & life cycle of *Nosema assamensis* – a pathogen causing pebrine disease of muga silkworm and a new strategy for sustainable development of muga culture in North Eastern India. (Abs.) *p.32*.
- 3. Choudhury, B.N., Pachuau, L. and Kakati, B.T. (2018). Prospect of muga culture in Mzoram and scope for sustainability. (Abs.) *p.40*.
- 4. Pachuau, L., Choudhury, B.N. and Gogoi, S.N. (2018). Conservation of wild muga in Mizoram. (Abs.) *p.120*.

National: 9 Nos.

National seminar on "Emerging Areas of Sericulture: Issues, Challenges and Industrial Application for Sustainable Development and Eco-Restoration" held from 30th-31st January 2018 at the Deartment of Sericulture (Centre for Applied Bioloy), Raiganj University, Raiganj, Uttar Dinajpur, West Bengal.

- 1. Afroz, S., Manjunath, G.R., Takhe, A., Biswas, T.D., Das, D., Pandit, D. and Trivedy, K. (2018). Effectiveness of m-kissan SMS based Advisory services for the information needs of the sericulture farmers of West Bengal. (*Abs.*).p. 18.
- 2. Chandrakanth, N., Lakshmanan, V., Verma, A.K. and Trivedy, K. (2018). Identification of potential thermo tolerant bivoltine silkworm breeds through phenotypic and molecular approach. (*Abs.*).p.7.
- 3. Datta, U. and Verma, A.K. (2018). Insect pests of mulberry –a review work. (*Abs.*). p.55.
- Hossain, Z., Singh, L. J. K., Rahul, K., Santha Kumar, M.V. and Trivedy, K. (2018). Bacteria isolated from some insects of the mulberry ecosystem causing bacteriosis in silkworm *Bombyx mori* L. OP. Sl. No. 24. (*Abs.*).p.28.

- 5. Manjunath, G.R., Afroz, S., Pandit, D. and Trivedy, K. (2018). Trend analysis of mulberry silk production in West Bengal. (*Abs.*).*p.19*.
- Pappachan, A., Mahesh, R., Suresh, K., Chakravarty, D. and Trivedy, K. (2018). Assessment of mulberry leaf yield improvement through foliar application of *Ascophyllum nodosum* and *Kappaphycus alvarezii* seaweed extracts. (*Abs.*).p. 41.
- 7. Suresh, K., Chakravarty, D., Pappachan, A., Ghosh, P.K., Jalaja S. Kumar, Ghosh, M. K. and Trivedy, K. (2018). Development of high yielding triploid mulberry genotypes suitable for irrigated subtropical condition. (*Abs.*). *p.54*.

Proceedings of National seminar on Seri-breeders' meet, 2018 held during 20th & 21st February, 2018 at Central Silk Board, Bengaluru, Karnataka.

- 1. Chakrabarty, D., Suresh, K., Pappachan, A. and Trivedy, K. (2018). Breeding mulberry varieties for Eastern and North-Eastern India: *Present status and future strategies. pp. 12-21.*
- Verma, A. K., Lakshmanan V., Chandrakanth, N. and Trivedy, K. (2018). Breeding strategies for development of silkworm breeds / hybrids for Eastern and North-Eastern India: *Present status and future strategies*. pp. 71-79.

18. CONSULTANCY & OTHER SERVICES RENDERED

- NIL –

19. KEY SCIENTIFIC RECOMMENDATIONS MADE BY THE RAC, RC & RRAC

Place	Events	Time Schedule
	RAC	21 st & 22 nd Aug., 2017; 9 th Jan., 2018
	RC	12 th and 13 th June, 2017; 18 th , 20 th and 22 nd
		Nov., 2017
CSR&TI, Berhampore	CPP	6 th Bv. CPP on 23.08.2017
		7 th Bv CPP on 10.01.2018
	EOM	1 st EOM on 24.08.2017
		2 nd EOM on 11.01.2018&
RSRS, Kalimpong		27 th Nov., 2017
RSRS, Koraput	RRAC	24 th June, 2017 & 14 th Dec., 2017
RSRS, Jorhat		20 th June, 2017 & 06 th Dec, 2017

Major Recommendations:

A. Research Advisory Committee (RAC):

1. 46th meeting held during 21st & 22nd August, 2017

- Concentrate on *product oriented* and *news making* research.
- To combat mulberry diseases and pests, adopt biological methods.
- Publications quality needs to be improved.
- Taking up of more research activities in relation to drought tolerance, mechanization.
- Develop solar based reeling machine.
- Study and update the socio-economic status of the sericulture area.
- Take care of natural resource management for sustainable development of Sericulture.
- Projects having same objective can be grouped into a common programme with different activities / sub-project for easy and quality assessment of the progress.

2. 47th meeting held on 9th January, 2018

- Research and Sericulture industry linkage needs to be strengthen further to sustain maximum benefits to farmers.
- Concentrate to develop online courses related to sericulture which will be beneficial in skill development of the stakeholders.
- Formulate projects in relation to reduction of drudgery in Sericulture through automation.
- Concentrate research on the social science sector in line to market requirements and linking of *kissan* clusters with banking sector.
- Manage presentations of salient achievements with major results before RAC.

B. Research Council (RC):

1. 46th meeting held during 12th and 13th June, 2017.

- Advised to develop a preservation and hibernation schedule for Multi x Bi (AIB 3514).
- Advised to present the comparative data of Bi x Multi and Multi x Bi with hatching (%).
- Advised to take up a pilot study to compare the efficiency of PM x (B.Con.1 x B.Con.4) with N x (SK6 x SK7) and N x (B.Con.1 xB.Con.4) because the ICB, PM x (B.Con.1 x B.Con.4) has lot of demand in the Tripura state.
- Perform the estimation of protein (by Folin Lowry and micro Kjehadl method) and carbohydrates of mulberry varieties/genotypes viz., PMY-5, S1635 and C2038 of top, middle and lower leaves (**PIB 3521**).
- Proper reports of progress and expenditure incurred on the project/ Progs/ PS should be maintained.
- Concluded reports of the Projects/ Programmes/ Pilot studies to be submitted as per milestone for onward transmission to Central Office, Bangalore.
- Advised to submit the progress reports (monthly/ quarterly/ yearly) and concluded reports in quantifiable terms.

2. 47th meeting held during 18th, 20th and 22nd Nov., 2017

- Test the quality control parameters' of the developed products twice in a year by out sourcing.
- Conduct ECP that should be achieved as per the set target within due time.
- Selection of silkworm breeds should not be solely based only on survivability and other important parameters such as fecundity and cocoon traits should also be taken into account, tolerance index should be quantified and Survival curve should be established for both male and female separately.
- The package of practices of newly developed mulberry varieties such as C-2038 & Tr-23 should be taken up with new project to exploit their full genetic potentiality.
- Organize the Institute bio-safety meeting timely.
- Check the toxicity of phototrophic bacterial extract on silkworm larvae alongwith the bioassay study for determining the optimum dosage of the extract.
- Advised to take-up a study on non-spinning of silkworm larvae giving more focus on the screening of new generation pesticides having low residual toxicity on silkworm
- Scientists of extension division were advised to submit a success story under this programme for publications.

C. Regional Research Advisory Committee (RRAC): (a). RSRS, KALIMPONG:

1. 8th Meeting held on 27th Nov., 2017

- Released the book 'Technology Descriptor' in vernacular language.
- Messages should be broadcasted through *m*-*Kissan* portal for the farmers of Sikkim also.
- Prepare and issue soil health card to the farmers' of Kalimpong and Sikkim, from those field the soil samples were collected.
- Keep record of larval and cocoon characters of bivoltine breeds maintained under germplasm.
- Standardize rearing capacity at farmers' level in Sikkim based on the assessment of leaf productivity.
- DoT (Seri), Kalimpong to put joint effort with RO, CSB, Kolkata to settle the issue of certification pertaining to Chawki Rearing Centre and registration of seed cocoon producers.
- Arrange exposure visit of farmers of Sikkim to Kalimpong to gather know-how of the sericulture technologies prevailing in this hilly region.
- Bio-pesticides may be tested in Sikkim to control pest infestation. Besides, *Aristimia vulgaris*/ cardamom may also be intercropped with mulberry growing in Sikkim as those are reported to have natural pest control ability.

(b). RSRS, KORAPUT:

1. 22nd Meeting held on 24th June, 2017

- Soil health cards for individual sericulture farmers are to be prepared.
- The staff will be trained on collection of soil samples from the mulberry fields of the farmers.
- Chairman was requested to help for outsourcing the testing of soil samples in Odisha.
- During the bioassay studies, the larval weight should be taken during all instars before entering moult.
- The comparative growth may be presented graphically for its analysis.
- The farmers may be facilitated with exposure visits to the better performers in cocoon production.
- Farmers should be encouraged to speak about their success stories.
- The treatment of paper sludge at the RRTTS has shown remarkable difference in productivity. Hence the application of the same may also be taken with the farmers.
- Performance of Eri Basic Seed Farm, Koraput may be presented in the forthcoming meetings.

2. 23rd Meeting held on 14th Dec., 2017

- Application of Green Manure such as Sun hemp and Dhanicha, regularly to increase the soil health.
- Trial of both mulberry and silkworm rearing should be continued for a period of three years to get a variety/breed for the region.
- Use of Neem cake in soil in three split doses to control pests.
- It was decided to encourage farmers for trenching and mulching of weeds by preparing furrows in the field and reuse it as manure for better leaf yield.
- The farmers should be encouraged for use of vermin-compost and each farmer should have their own vermi-compost pit.
- Data to be presented in frequency distribution table/ graph.

(C). RSRS, JORHAT:

1. 23rd Meeting held on 20th June, 2017

- 48 lakh dfls are required in NE States annually and the major portion of the dfls is being supplied by NSSO, Bangalore.
- Suitable seed zones may be developed in BTC, Darrang, Karbi Anglong, Dima Hasaw and Majuli also.
- Install the reeling machines supplied earlier as the same were lying at farmers houses of Jorhat due to lack of operational knowledge and supply the remaining reeling machines as early as possible.
- Submit a performance and testing report in the next meeting.
- Formulate three years project for testing of performance of C x J and J-112 which were found suitable in Manipur and Mizoram.
- Go for testing of two hybrids should be done in the different localities of NE region with two control (B.Con.1 x B. Con4 and SK6 x SK7).
- The Local breed from Meghalaya may be also be included in the programme.

2. 23rd Meeting held on 6th Dec., 2017

- Sericultural training to the farmers should be in the line of KVC, ICAR which is one of the best training available presently.
- Provide minimum infrastructures to the sericulture farmers such as fenching for mulberry plantations for protection from cattles.
- Establish a mini grainage in Darrang district which can helps the SSPC, Jorhat as a sister unit to enhance the seed production.
- One multiend reeling machine was installed in BTC area and it is required 100 kg cocoon/ day for reeling, DoS, Assam may be informed for solving cocoon marketing. Select new seed rearers by SSPC, Jorhat, Assam, to enhance seed production.
- SSPC, Jorhat should put stress on development of seed by due to high demand of bi-voltine seeds in North Eastern States.
- Provide all technologies like suitable breeds, high yielding mulberry varieties to enhance productivity in the region.

20. RESHAM KRISHI MELA, WORKSHOP, SEMINER AND FARMERS DAY ORGANIZED:

20. A. RESHAM KRISHI MELAS: 20. A.1.Main Institute

20. A.1.1. Resham Krishi Mela Venue: CSR&TI, Berhampore Date: 18.01.2018

A Resham Krishi Mela was organized at the Institute. A total of 1200 farmers from Malda, Nadia, Birbhum and Murshidbad districts and officials of DoS, WB were participated in the RKM. An Exhibition was also organized. The *Hon'ble Chairman*, *Central Silk Board (CSB) - Shri K. M. Hanumantharayappa* was attended the programme as Chief Guest. The other dignitaries were present in the auspicious occasion were Commissioner (DoT, Seri), West Bengal, Smt. Madhumita Choudhuri,



IAS; Principal, Govt. College of Engineering & Textile Technology, Shri Abhijit Biswas and Dr. K. Trivedy, Director, CSR&TI Berhampore. On the occasion, eighteen (18) best farmers, selected from the different districts of West Bengal for their outstanding achievements in cocoon production during previous year, were awarded.

20. A.2.Nested Units

20. A.2.1. Mini Resham Krishi Mela Venue: REC, Bhandra, Jharkhand Date: 03.11.2017.

A Mini **Resham Krishi Mela** (**RKM**) cum exhibition on recent technologies of sericulture was organised at REC-Bhandra on 03.11.2017. About 110 farmers were attended at this Mela.



20. A.2.2. Mini Resham Krishi Mela Venue: REC, M.P. Raj, Jharkhand Date: 10.11.2017.

A Mini **Resham Krishi Mela (RKM)** was conducted at REC, M.P. Raj on 10.11.2017. Shri Umesh Mandal, Block Development Officer, M.P. Raj and Smt Kavita Mandal, Upa-Mukhiya Panchayat Samity were the Chief Guest and Guests of



Honour. A total of 130 participants were participated in the programme.

20. A.2.3. RSRS, KORAPUT Venue: Chandragiri, Odisha Date: 12.12.2017.

A Resham Krishi Mela cum Exhibition was organized at Chandragiri. Dr. Kanika Trivedy, Director, CSR&TI Berhampore, Elected leaders from Panchayat Samiti, ADS, Chandragiri attended the programme. A total of 134 farmers from the adjacent area attended in the mela. The better performers were felicitated in the meeting.

Venue: Kashipur, Odisha Date: 09.03.2018

A Mini Kissan Meet was organized by Kashipur CPP cluster. Block Development officer presided the meeting. Additional BDO Kashipur, ADS, Koraput, also attended the programme. A total of 113 farmers from the adjacent area attended in the mela. The better performers were felicitated in the meeting

20. A.2.1. Resham Krishi Mela Venue: RSRS, Joraht, Assam Date: 07.12.2017

A Resham Krishi Mela cum Exhibition on mulberry sericulture was organized by RSRS, Jorhat, Assam. A total of 420 farmers from Jorhat, Sibsagor, Majuli, Golaghat and Lakhimpore







districts were participated in the programme. The function was attended by officials of DoS, Assam & BTC and all the scientists of RSRS, Jorhat and incharges of REC, Aizawl; REC Agartala; REC, Dimapur; REC, Imphal ; REC, Mongaldoi & REC, Shillong. An Exhibition was also organized displaying about the latest technologies on mulberry sericulture for the benefit of farmers.



Programme was presided over by Dr. M. Konwar, Principal, Central College, Jorhat, Assam. Dr. L.K. Hazarika, Chairman RRAC, Jorhat, Assam, Emeritus professor & Registrar of Assam Woman University attended as chief guest in the function. Dr. Kanika Trivedy, Director, CSR&TI, Berhampore; Dr. M. N. Saikia, ACS, Director, DOS, Assam ; Sri Satish Kumar, R. Director, Finance, Central Office Bangalore ; Dr. M. C. Sarma, Sc.-D, CMER&TI, Lahdoigarh, Jorhat and Sri M.N. Bora , Principal, Sericultural Training Institute were attended as guest of honour in the function. Dr.S.N. Gogoi, Sci.-D, RSRS, Jorhat, briefed R&D of RSRS, Jorhat, Assam of mulberry sericulture in North eastern states. Ten (10) best mulberry farmers were awarded in the programme.

20. A.2.2. Mini Resham Krishi Mela Venue: Ummulong, West Jaintia Date: 17.03.2018

A Mni Resham Krishi Mela was organized at Ummulong, West Jaintia. The programme was inaugurated by the Hon'ble Chairman, Central



Silk Board- Shri K. M. Hanumantharayappa; Commissioner (DoT, Seri), West Bengal, Dr. K. Trivedy, Director CSR&TI Berhampore and other distinguish invitees. A total of 212 participants were participated in the Mela.

20. A.2.2. Mini Resham Krishi Mela Venue: REC Dimapur, Nagaland Date: 05.12.2017

A mini RKM was organized at REC Dimapur, Nagaland on 5th December, 2017. Dr. Kanika Trivedy was the chief guest of the occasion.

20. A.2.Nested Units 20. A.2.1. Resham Krishi Mela Venue: REC. Dhenkikote Keonihar. Odisha Date: 14.03.2018

A mini RKM was organized at MRCS, campus Dhenkikote where about 138 farmers,



& DoS officers participate officials in the programme. Dr. K.C. Brahma Sci-D. RSRS.





Koraput presided over the Mela. Dr.P.K. Kar Sci-D. RTRS, Baripada

explained technology of silk worms rearing for better and sure harvest of Multi & Bv. crop in Ghatagaon Cluster. Dr. Subrat Satapathy, Sci-C explained technology required for success BV silkworm rearing. On this occasion, 5 cell phones were rewarded to the best farmers

20.B. SEMINAR/ WORKSHOP 20.B.1.Main Institute- Hindi Workshop Date: 05.04.2017

Hindi Α Workshop on "Contribution of e-tools for the of the official development Language" was organised for updating the e-knowledge and skills of the officials for working in Hindi in all



official works. A total of 42 officials comprising of different cadres actively participated in the said Workshop.

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20.B.2. Workshop on Chawki Rearing Venue: CSR&TI, Berhampore Date: 09.03.2018

A "Workshop on Chawki Rearing" was organized at CSR&TI, Berhampore. The programme was inaugurated by Prof. Indranil Biswas, the Director and Senior scientists of the Institute through watering of mulberry potted



plant. During the programme a Bengali booklet on "*Chawki Rearing*" was released. A series of guest lecturers by the institute scientists and practical demonstration on chawki rearing was arranged for the ~ 80 nos. CRC owners/ participants.

Venue: RSRS, Kalimpong, West Bengal Date: 03.02.2018

RSRS, Kalimpong organized a workshop on "Intellectual Property Right as well as Technology Transfer & Commercialization" at its office



premises on 3rd Feb., 2018 with a view to have in-depth information on protection of expression of ideas as well as its dissemination, in turn.



dissemination, in turn. Scientists, planners and executives from different institutes/ organizations were invited in this auspicious occasion as they are very in terms of today's lengulades based accommu

much linked with the subject in terms of today's knowledge based economy.

20.B. State Level Sericultural Workshop Venue: Bhubaneswar, Odisha [RSRS, Koraput] Date: 28.02.2018

A **State Level Sericultural workshop** was organized at Bhubaeswar by RSRS, Koraput, Odisha. Smt. Subha Sarma, Commissioner of Textiles, Governent of Odisha was the guest of Honour. Dr. Kanika Trivedy, Director, CSR&TI, Berhampore was present in the auspicious



occasion and made her valuable speech to the audience. A book entitled Resham Marga Darshika was released during the program. 70 stakeholders attended in the workshop.



राजभाषा अनुभाग की उपलब्धियाँ (वर्ष 2017- 2018)

केन्द्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, बहरमपुर(प.बं.) में वर्ष 2017-18 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 का आयोजन हिन्दी पखवाड़ा/दिवस का आयोजन, हिन्दी भाषा प्रशिक्षण, हिन्दी पुस्तक/ पुस्तिकाओं का संपादन, हिन्दी प्रतियोगिता का आयोजन एवं प्रोत्साहन योजनाओं का कार्यान्वयन किया गया।

फलस्वरुप, दिनांक 10वीं मार्च, 2018 को "भारत के पूर्वी तथा पुर्वोत्तर राज्यों" के लिए ज्ञान भवन ऑडिटोरियम, गाँधी मैदान, पटना में में आयोजित क्षेत्रीय राजभाषा सम्मेलन के दौरान समारोह के मुख्य अतिथि माननीय गृह राज्य मंत्री, श्री किरण रिजुजु महोदय के करकमलों द्वारा वर्ष 2016-17 के दौरान राजभाषा नीति के कार्यान्वयन में उत्कृष्ट योगदान के लिए राजभाषा शील्ड अर्थात् द्वितीय पुरस्कार से सम्मानित होने का सुअवसर इस संस्थान को प्राप्त हुआ।

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

- धारा-3(3) का अनुपालन: राजभाषा अधिनियम की धारा-3(3) के अर्न्तगत आने वाले सभी कागजात यथा सामान्य आदेश, निविदा, नियम, सूचना, अधिसूचना एवं संविदा करार विज्ञप्ति तथा प्रशासनिक एवं अन्य रिपोर्ट आदि अनिवार्य रुप से द्विभाषी में जारी किए गए।
- 2. हिन्दी पत्राचार :वर्ष के दौरान 'क', क्षेत्र में स्थित केन्द्र / राज्य सरकार को क्रमश: 88.40%, तथा 'ग' क्षेत्र में स्थित केन्द्रीय सरकार के कार्यालयों को 67.38% पत्र हिन्दी में भेजें गए। इस प्रकार पत्राचार के मद में निर्धारित लक्ष्य से अधिक पत्राचार किया गया।
- हिन्दी प्रशिक्षण :आलोच्य अवधि के दौरान अधिकारियों/कर्मचारियों को हिन्दी शिक्षण के योजना के अधीन प्रशिक्षण कार्य जारी है। इस दौरान संस्थान के कुल 03
पदधारी हिंदी प्रशिक्षण हेतु विविध पाठ्यक्रम [प्रवीण-02 एवं प्राज्ञ -01] के अंतर्गत नामित किए गए। अब तक संस्थान के कुल 94.16% अधिकारी/कर्मचारी इस योजना के अन्तर्गत प्रशिक्षित हो चुके है।

- 4. राजभाषा कार्यान्वयन समिति की बैठकों 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 2017-18 के अंतर्गत राजभाषा कार्यान्वयन समिति की चार बैठकों का नियमित आयोजन क्रमश: दिनांक 27.04.2017, 20.07.2017, 21.10.2017 एवं 12.01.2018 को किया गया तथा बैठक में लिए गए निर्णयों पर अनुवर्ती कारवाई 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 अधिकारियों/पदधारियों के लिए राजभाषा के विविध पहलुओं पर क्रमशः 05.04.2017, 18.09.2017, 21.12.2017 एवं 22.03.2018 को हिंदी कार्यशाला आयोजित कर संस्थान के कुल 115 पदधारीगण [अधिकारी 65 एवं पदधारी 50] 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 संस्थान के कुल 12 अधीनस्थ केन्द्रों में भी 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 अभिरूचि 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 (महत्तम रू 2000.00) प्रदान की जाती है। हिन्दी दिवस/पखवाड़ा, 2017 के अवसर पर वर्ष 2016-17 के दौरान मूल रूप से हिन्दी में कामकाज करने हेतु कुल 08 पदधारियों को पुरस्कृत किया गया।

- 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 तथा मूल रुप से हिंदी में लिखित पुस्तकें आवश्यकतानुसार प्रकाशित की जाती है। वर्तमान वर्ष के अंर्तगत संस्थान की वार्षिक वैज्ञानिक एवं प्रशासनिक रिपोर्ट वर्ष 2016-17 का सारांश हिंदी में प्रकाशित करने के अतिरिक्त आलोच्य अवधि के दौरान रेशम कृषि मेला के अवसर पर "स्कीमनस प्लॉयडिकली पूर्णिल मत्कुण का एक परभक्षी" शीर्षक से एक लीफ्लेट हिंदी भाषा में तथा B.Con1 x B.Con.4 एक उज्ज्वल संभावनापूर्ण संकर प्रजाति नवीन जापानी कीट, ब्रशिंग ऑफ लुज एग, रोग मुक्त कीटपालन के लिए परिशोधन व स्वच्छता एवं टीआर-23 पूर्वी तथा उत्तर-पूर्वी भारत के उष्णकटिबंधीय पहाड़ी अंचल के लिए उपयोगी शहतूत पौध" शीर्षक से चार लीफ्लेट बंगला भाषा में प्रकाशित की गई।
- 9. नगर राजभाषा कार्यान्वयन समिति का गठन एवं उसकी बैठकों का आयोजन:वर्ष 1997-98 के शुरूआत में ही राजभाषा विभाग, भारत सरकार, नई दिल्ली द्वारा संस्थान के निदेशक की अध्यक्षता में नगर राजभाषा कार्यान्वयन समिति के गठन, बैठकों के नियमित आयोजन 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 33वीं बैठक दिनांक 05.04.2017 तथा दिनांक 18.09.2017 को 34वीं बैठक संपन्न की गई। समिति के प्रयास से नगर स्थित केन्द्रीय सरकार के कार्यालयों/ बैंकों/निगमों/ उपक्रमों/ संगठनों आदि में भी राजभाषा गतिविधियां बढ़ी है। इसके अतिरिक्त, नगर के सदस्य कार्यालय अपने-अपने कार्यालयों में हिन्दी दिवस, प्रतियोगिता, संगोष्ठी कार्यशाला एवं बैठकों का आयोजन कर रहे है। समिति की उक्त गतिविधियों के संचालन से संस्थान में राजभाषा कार्यान्वयन संबंधी कार्यमात्रा में भी अत्याधिक वृद्धि हुई है।

- 10. राजभाषा नियम 10(4) के अर्न्तगत अधीनस्थ कार्यालयों को अधिसूचित किया जाना: संस्थान के संबद्ध / अधीनस्थ केन्द्रों में कार्यरत 80% कर्मचारियों को हिन्दी प्रशिक्षण दिलाने के पश्चात ऐसे कार्यालयों को मंत्रालय द्वारा राजभाषा नियम-10(4) के अधीन अधिसूचित करने की कार्रवाई की जाती है। इस क्रम में संस्थान के 08 संबद्ध कार्यालयों को अधिसूचित कराया जा चुका है।
- 11. हिन्दी प्रतियोगिता का आयोजन : वर्ष 2017-18 के दौरान दिनांक 01.09.17 से 14.09.17 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 09 हिन्दी प्रतियोगिताओं क्रमश: हिंदी टिप्पण व आलेखन एवं शब्दावली 01/09/2017, निबन्ध एवं वाद -विवाद 04/09/2017, सुलेख व श्रुतिलेख 05/09/2017 राजभाषा प्रश्नोत्तरी एवं स्मृति परीक्षण 06/09/2017 हिंदी टंकण 07/09/2017 तथा तात्क्षणिक भाषण प्रतियोगिता 08/09/17 का आयोजन किया गया। प्रत्येक प्रतियोगिता के सर्वश्रेष्ठ प्रतिभागियों को प्रथम, द्वितीय, तृतीय एवं सांत्वना पुरस्कार से पुरस्कृत किए गए।
- 12. कंप्यूटर पर हिन्दी में कार्य: राजभाषा अधिनियम-1963 की धारा 3(3) का अनुपालन, फार्म/प्रपत्र का द्विभाषीकरण, संबद्ध/ अधीनस्थ केन्द्रों की तिमाही रिपार्ट 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 कंप्यूटर पर सुचारू रूप से किया जा रहा है। राजभाषा कार्यान्वयन के विभिन्न पहलुओं में कंप्यूटर के प्रयोग की शुरूआत से राजभाषा कार्यान्वयन के कार्य में गति आई है साथ ही साथ संस्थान की राजभाषा कार्यान्वयन के विभिन्न पहलुओं में कंप्यूटर के प्रयोग की शुरूआत से राजभाषा कार्यान्वयन के कार्य में गति आई है साथ ही साथ संस्थान की राजभाषा कार्यान्वयन समिति की बैठको में हिन्दी प्रगति से संबंधित आकड़ों का प्रस्तुतीकरण पावर-प्वाइंट के जरिये किया जा रहा है। जातव्य है कि संस्थान में बहुभाषी पैकेज "यूनिकोड" का संस्थापन कंप्यूटर पर किया गया है जिससे शब्द प्रक्रमण के अलावा आकड़ों के प्रक्रमण, आरेखीय निरूपण, आंकड़ों के समेकीकरण में सहुलियत एवं गति आई है।

क्षेरेउअके, कलिम्पोंगः

• वर्ष 2017-18 के दौरान क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्र, कलिम्पोंग की राजभाषा कार्यान्वयन समिति की बैठकें क्रमशः दिनांक 03.06.2017, 29.09.2017, 22.12.2017 एवं 19.03.2018 को केन्द्र के वैज्ञानिक-डी की अध्यक्षता में संपन्न की गई।

- वर्ष 2017-18 के दौरान क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्र, कलिम्पोंग के परिसर में नगर राजभाषा कार्यान्वयन समिति, कलिम्पोंग की बैठकें क्रमशः दिनांक 05.12.2017 को केन्द्र के वैज्ञानिक-डी की अध्यक्षता में संपन्न की गई।
- केन्द्र में दिनांक 29.09.2017 हिंदी दिवस का आयोजन किया गया।
- क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्र, कलिम्पोंग में दिनांक 22.12.2017 व 21.03.2018 को क्षेरेउअके, कलिम्पोंग एवं नराकास सदस्यों के पदधारियों के लिए एक हिंदी कार्यशाला का आयोजन किया गया।

क्षेरेउअके, कोरापुटः

- वर्ष 2017-18 के दौरान क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्र, कोरापुट की राजभाषा कार्यान्वयन समिति की बैठकें क्रमशः दिनांक 30.06.2017, 27.09.2017, 30.12.2017 एवं 31.03.2018 को केन्द्र के वैज्ञानिक-डी की अध्यक्षता में संपन्न की गई।
- केन्द्र में दिनांक 4.09.2017 से 18.09.2017 तक हिंदी पखवाड़ा का आयोजन किया गया।
- क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्र, कोरापुट में दिनांक 18.09.2017 एवं 28.03.2018 को केन्द्र के सभी अधिकारियों एवं पदधारियों के लिए एक हिंदी कार्यशाला का आयोजन किया गया।
- क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्र, कोरापुट कोरापुट वृत्त में स्थित कार्यालय भाषा हिंदी के कार्यान्वयन में पहला पुरस्कार प्राप्त हुआ, जिसमें 2017- 18 के लिए "नगर राज भाषा क्रियान्वयन समिति" के 45 केंद्र सरकार संगठन द्वारा भाग लिया गया था।
- क्षेरेउअके, जोरहाट : खेत्रिय रेशम अनुसंधान केन्द्र , जोरहाट(असम) में वर्ष 2016-17 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 ! राजभाषा हिन्दी के अन्य महत्वापूर्ण कार्यान्वयन बिन्दुओ/ प्रावधानों पर भी कार्रवाई की गई ! केन्द्र में राजभाषा कार्यान्वयन समिति की बैठक का आयोजन राजभाषा प्रगति/ कमियों की समय-समय

पर समीक्षा, हिन्दी कार्यशाला का आयोजन, हिन्दी दिवस/पखवाडा का आयोजन एवं प्रोत्साहन योजनाओं का कार्यान्वयन किया गया !

<u>केन्द्र द्वारा वर्ष के दौरान विभिन्न कार्यान्वयन बिन्दुओं पर की गई कार्रवाई का व्योरा</u> <u>निम्नवत है</u> :

- धारा 3(3) का अनुपालन : राजभाषा अधिनियम की धारा -3(3) के अंतर्गत आने वाले सभी कागजात यथा सामान्य आदेश, निविदा, नियम, सूचना, अधिसूचना एवं करार, विज्ञप्ति तथा प्रशासनिक एवं अन्य रिपोर्ट आदि द्विभाषी, हिन्दी-अंग्रेजी रुप में जरी किए गए !
- हिन्दी पत्राचार : वर्ष के दौरान 'क ' 'ख 'क्षेत्र में स्थित केन्द्र / राज्य सरकार को 100% तथा 'ग 'क्षेत्र में स्थित केन्द्रीय सरकार के कार्यालयों को 78% पत्र हिन्दी में भेजे गए ! इस प्रकार पत्राचार के मद में लक्ष्य से अधिक पत्राचार किया गया !
- हिन्दी प्रशिक्षण : आलोच्य अवधि के दौरान अधिकारियों / कर्मचारियों को हिन्दी शिक्षण योजना के अधीन प्रशिक्षण कार्य जारी किया गया तथा 100% अधिकारी/कर्मचारी इस योजना के अंतर्गत प्रशिक्षित हो चुके है !
- राजभाषा कार्यन्यन समिति की बैठक का आयोजन : राजभाषा नियम /अधिनियम के प्रावधानों के सम्यक अनुपालन एवं समय -समय पर राजभाषा कार्यों की प्रगरि/ कमियों की समीक्षा हेतु केन्द्र में प्रत्येक तिमाही के दौरान राजभाषा कार्यांन्यन समिति की बैठक का आयोजन कर कार्यान्यन की दिशा में आने वाली कठिनाईयों का निदान किया जाता है ! कार्यान्ययन समिति की चार बैठकों का नियमित रुप से आयोजन क्रमश: दिनांक 28.06.2016, 20.08.2016, 26.12.2016 एवं 10.03.2017 को किया गया ! बैठक में लिए गए निर्णयों पर अनुवर्ती कार्रवाई भी पूरी की गई !
- हिन्दी कार्यशाला का आयोजन : केन्द्र में कार्यरत अधिकारियों / कर्मचारियों को हिन्दी में काम - काज करने में मदद करने हेतु प्रत्येक तिमाही के दौरान एकदिवसीय हिन्दी कार्यशाला का आयोजन क्रमश: दिनांक 28.06.2016, 23.08.2016, 26.12.2016 एवं 10.03.2017 को किया गया !
- राजभाषा प्रोत्साहन योजना का कार्यान्यन : केन्द्र में कार्यरत अधिकारियों / कर्मचारियों में राजाभाषा हिन्दी के प्रति अभरुचि जगाने हेतु प्रतियोगिता क अयोजन किया जाता है! हिन्दी में मूल रुप से टिप्प्ण - आलेखन करने वाले अधिकारियों/कर्मचारियोंके लिएअ केन्द्रीय रेशम बोर्ड की उदारीकृत राजभाषा प्रोत्साहन योजना को भी लागू किया

गया है जिसके अंतर्गत निर्धातित शब्द संख्या हिन्दी में लिखने पर अनुपातत: नगद प्रोत्साहन राशि (महत्त्म राशि रु.2000/-) प्रदान की जाती है! हिन्दी दिवस/पखवारा, 2016 के अवसर पर वर्ष 2015-116 के दौरान मूल रुप से हिन्दी में काम काज करने हेत् 7 अधिकारियों/ कर्मचारियों को प्रस्कृत किया गया !

 हिन्दी दिवस/पखवारा का आयोजन : दिनांक 01.09.2016 से 14.09.2016 तक हिन्दी पखवारा का आयोजन किया गया ! इस अवसर पर विभिन्न हिन्दी प्रतियोगिताओं का आयोजन किया गया! इन प्रतियोगिताओं में केन्द्र के अधिकारियों/ कर्मचारियों ने उत्साह से भाग लिया! इस दौरान कुल 05 हिन्दी प्रतियोगिताओं क्रमश: टिप्पण - आलेखन एवं शब्दावली अनुवाद 09.09.2016, कविता पठन, तत्काल भाषण एवं हिंदी गान - 14.09.2016 का आयोजन किया गया! प्रत्येक प्रतियोगिता के प्रथम, द्वितीय, एवं तृतीय प्रतिभागियों को नगद प्रस्कार प्रदान किया गया !





- कम्प्यूटर पर हिन्दी में कार्य : केन्द्र में राजभाषा अधिनियम 1963 के धारा 3(3) का अनुपालन फार्म / प्रपत्र का द्विभाषीकरण अनुभागीय तिमाही प्रगति रिपोर्ट के तुलनात्मक विवरण, हिंदी पत्राचार, राजभाषा कार्यान्यन समिति की गतिविधियों संबन्धी कार्य को कम्प्यूटर पर सुचारु रुप से किया जा रहा है ! केन्द्र के कम्प्यूटरों पर "योनिकोड" संस्थापित किया गया है जिससे शब्द प्रक्रमण के अलावा आंकडो के प्रक्रमण में सहुलियत प्राप्त हुई है !
- पुरस्कार प्राप्त : इस केंद्र को जोरहाट सद्स्य कार्यालयों में उल्लखनीय राजभाषा हिंदी कार्यावयन के लिए नगर राजभाषा कार्याव्यन समिति जोरहाट (भारत सरकार, गृह मंत्रालय, राजभाषा विभाग) द्वारा वर्ष 2015-16 का श्रेष्ठ्ता पुरस्कार प्राप्त किया है ।

22.IMPLEMENTATION OF RTI ACT, 2005

#	Applicant and address	Requested to and	Details of comp rejection of re	Relevant RTI	Amount of	
		Date of	Office order No.	Date	section, if	Charges
		Request			request	collected
					rejected	(in Rs.)
1	Dr. Basumati, T.,	The Director	No.	dated	-	Rs.50/-
	Kalicut University	CSRTI,	CSB/CSR&TI/PMC	15.01.2018		(IPO
	Staff, Quarter No. D/2,	Berhampore	E/R-38(F)/2017-18/			No. 89G
	Kalicut University Post	dt.	11496			649581)
	Office, Pin- 673635	05.01.2018				
	Mallapuram	(Received on				
	District,Kerala	10.01.2018)				

23. A. DISTINGUISHED VISITORS: MI FOLLOWING DISTINGUISHED PERSONNEL VISITED THIS INSTITUTE

#	Name	Designation	Date
1.	Ms. Madhumita Choudhury,	Commissioner, Dept. of Agriculture, Govt.	08.06.2017
	IAS	of West Bengal	
2.	Md. Atikur Rahaman	Director, Bangladesh Sericulture	08.06.2017
		Development Board, Rajshahi, Bangaladesh	
3.	Dr. S. Ayappan	Chairman RCC., CSB [Former. Director	03.08.2017
		General, ICAR]	
4.	Dr. Sanjib Chopra, IAS	Addl. Chief Secretary, Dept. of Agriculture,	15.10.2017
		Govt. of West Bengal	
5.	Mr. Andee Baraiah	Tourist, New Zealand	29.11.2017
6.	Komoto Natua & Kajikatto	Professor, NARO, Japan	05.02.2018
7.	Shri Keshari Nath Tripathi	Hon'ble Governor of West Bengal	06.02.2018
8.	Shri K.M.Hanumantharayappa	Hon'ble Chairman, CSB, Bangalore	06.02.2018
9.	Katrina Woslien	Mayor, 61, Pleasant Street, Portland, USA	07.03.2018
10.	Md. Sohrab	Central Silk Board's Member, Ex. MLA	07.03.2018





Smt. Madhumita Chowdhary, Commissioner of Agriculture visited the institute (08.06.2017)

Hon'ble Governor of West Bengal, Shri Keshari Nath Tripathi visited this institute on the eve of Platinum Jubilee celebration. (06.02.2018).





Dr. S. Ayyappan, Chairman RCC, Central Silk Board visited different areas of West Bengal on 1st week of Aug., 2017



Unveiling of the Platinum Jubilee Stone/Plaque has done by the Hon'ble Chairman of the Central Silk Board, Mr. K. M. Hanumantharayappa, Chief guest Dr. Sanjeev Chopra, IAS, Additional Chief Secretary, Dept of Agriculture, Govt. of West Bengal (15.10.17)



Scientists of CSR&TI, Berhampore interacted with Japaneese scientist during their visit on 05.02.2018

24. A. RESEARCH ADVISORY COMMITTEE (RAC)

Chairman

Dr. Chirantan Chattopadhyay,

ARS (ICAR), Vice Chancellor, Uttar Banga Krishi Viswavidyalaya (UBKV),

Pundibari, Coochbehar, West Bengal, India

#	Members, RAC		
1.	Dr. S. Nirmal Kumar, Ex-Director, Central Silk Board (CSB), No.1169, II Main, II Cross, SRIRAMPURA, IIStage, Mysore -570 023 , Karnataka	2.	Dr. S. Mukhopadhyay, Principal Scientist & Head GIS&RS, ICAR-NBSS&LUP, Bidhan Nagar, Sector-II, Koklata -700 091 WB
3.	Dr. Somnath Bhattacharya, Professor, Bidhan Chanadnra Krishi Viswavidyalaya (BCKV), Mohanpur -741 252, Nadia, West Bengal	4.	Prof. D.C. Ghosh, Former Professor of Agronomy, Viswa Bharathi University, Bolpur, Paschimpally, Shanti-niketan, Birbhum -731 235, West Bengal
5.	In-charge & Scientist - D, Silk Conditioning & Testing House, Central Silk Board, 76/B, I Floor, Sarbamangala Pally, Monakamana Road, Malda – 732 101 , WB	6.	Director (Tech.) & Head BV Cell, Central Silk Board, P.O. Madiwala, BTM Layout, Bangalore – 560 068 , Karnataka
7.	Md. Samsul Haque, <i>Rearers Representative</i> Vill. – Korjora, Block – Nabagram, Murshidabad – 742 184, W.B.	8.	Md. Ebarat Ali, <i>Reelers Representative</i> , VillDakshin Laxmipur Kazigram, Kaliachak, Malda – 732 201, WB
9.	Dr. Kanika Trivedy, Director, CSR&TI, (Memb. Convr.), Berhampore – 742 101 Murshidabad, West Bengal.	10.	The Commissioner, Director of Textiles, Govt. of West Bengal, 45 G.C. Avenue, Kolkata -700013, West Bengal.
11	Director of Textiles & Handloom Govt. of Orissa, Sahidnagar, Bhubaneswar - 751 007 , Odisha	12.	Director (Handloom & Seri.), Dept. of Industries, Govt. of Bihar, Vikas Sachivalaya, Patna- 800 015 , Bihar
13	Director of Sericulture & Weaving, Govt. of Meghalaya, 3 rd Sectt. (Nongkrek building), 2 nd Phase, 2 nd Floor, Lower lachumiere, Shillong – 793 001 , Meghalaya	14.	Director of Sericulture, Govt. of Chhattisgarh, Resham Sanchanalaya Kanij Bhawan, Ring Road, Telibandh Raipur- 492 06, Chhattisgarh
15	Director of Sericulture, Govt. of Nagaland, Kohima – 797 001, Nagaland	16.	Director of Sericulture, Govt. of Mizoram, Aizawl – 796 001, Mizoram
17	Director of Handlooms, Handicrafts & Sericul., Govt. of Tripura, Jawaharlal Nehru Complex, Gorkha Basti, Agartala–799006 , Tripura	18.	Director of Industries, Govt. of Jharkhand, III Floor, Nepal House, Doranda, Ranchi - 834 002 , Jharkhand
19	Director of Sericulture, Govt. of Manipur, P.O. Lamphelpat, Imphal –795 004, Manipur	20.	Director of Sericulture, Govt. of Assam (Near Research Gate), P.O. Khanapara, Guwahati-781 022, Assam
21	Director of Sericulture, Dept. of Forest & Environment, Govt. of Sikkim, Deorali, Gangtok – 737102, East Sikkim, Sikkim	22.	The Director, Director of Sericulture Boroland Territorial Council (BTC), Kekreihar 783370 BTAD Assam
23	The Director, Director of Textiles & Handicrafts, Govt. of Arunachal Pradesh, Udyog Sadan, Itanagar - 791 111, Anunachal Pradesh		KUKI AJHAI - 703370, DTAD, ASSam

24. B. REGIONAL RESEARCH ADVISORY COMMITTEE (RRAC) 24. B. I. RSRS, KALIMPONG, WEST BENGAL:

Sl.	Name	Position
No.		
1	Prof. D. C. Deb, Retired Professor, NBU, Siliguri, W.B.	Chairman
2	Director, CSR&TI, Berhampore	Vice-Chairman
3	Prof. S. Chakravarty, UBKV, Coochbehar	Member
4	Dr. M. W. Moktan, Darjeeling KVK, UBKV, Kalimpong	Member
5	Dr. R. Chetri, Sikkim Govt. College, Gangtok	Member
6	Dr. K. Sathyanarayana, Scientist-D, CSB, Bangalore	Member
7	Dr. Ranjit Kar, Scientist-D,RSRS, Kalimpong	Member Convener
8	Assistant Director, DoT (Seri.), Kalimpong, West Bengal	Member
9	Assistant Director, DoS, Sikkim	Member
10	Joint Secretary (Tech), R.O., CSB, Kolkata	Member
11	Shri Bendick Lepcha, Farmer' Representative, Khani, Kalimpong	Member
12	Shri Mon Bahadur Tamang, Farmer' Representative, Namthang, Lower Karak,South Sikkim	Member

24. B.II. RSRS, KORAPUT, ODISHA

#	Name	Position
1.	Dr. Niranjan Senapati, Chairman of RRAC, Principal Scientist, Centre for Pulses Research, Berhampore, Odisha	Chairman
2.	Dr. Kanika Trivedy, Director, CSR&TI, Berhampore, West Bengal	Vice–Chairman
3	Shri Bibhuti Bhusan Dalei, Junior Agronomist, Officer In- Charge, All India Coordinated Research Project on Niger (OUAT), Semiliguda, Odisha.	Member
4.	Mrs. Sunita Behera, Junior Scientist (Plant Pathology), High Altitude Research Station, Pottangi, Koraput (Odisha).	Member
5.	Dr. Binod Chandra Behera, Member, Scientist (Extension), K.V.K., Rayagada.	Member
6.	Dr K.C.Brahma, Scientist-D (I/C), RSRS, Koraput, Odisha	Member Convener
7.	Shri D. Behera, Deputy Secretary (Tech.) (I/C), Regional Office, Central Silk Board, Bhubaneswar (Odisha).	Member
8.	Shri Bijay Kumar Mishra, Production officer –HQ Office of the Assistant Director of Sericulture, (Nominated by the DOTH, Govt. of Odisha), Govt. of Odisha, Koraput.	Member
9.	Shri R. C. Das, Deputy Secretary (Tech), Nodal Officer for Odisha, Central Silk Board, CSB Complex, Madiwala, Bangalore-560 068, Karnataka	Member
10.	Shri.A.K.Srivastav, Member, Deputy Director (Seri), Jagdalpur, DOS, Chhattisgarh.	Member
11.	Shri Lakkidhar Jhadia, Village-Parajashila Kashipur. Rearer's rep.	Member
12.	Smt. Chitralekha Paik, Koraput, Odisha, Reeler's rep.	Member



24. B.III. RSRS, JORHAT, ASSAM

#	Name	Position
1.	Dr. L. K. Hazarika, Professor & Head, Entomology, Assam Agricultural University, Jorhat, Assam	Chairman
2.	Dr. Kanika Trivedy, Director, CSR&TI, Berhampore, West Bengal.	Vice–Chairman
3.	Dr. R. M. Bordoloi, Principal Scientist, Agricultural Technology Application Research Institute, Meghalaya	Member
4.	Mrs Lalramhluni, Agronomy, Subject Matter Specialist, Deptt. of Agriculture, Govt. of Mizoram, Aizawl Mizoram	Member
5.	Sri T. Sanny Pongener, Deputy Director, DOS, Nagaland, Kohima	Member
6.	Sri S. K. Mandal, Joint Director of Sericulture, Govt. of Assam (Represented by ADS, Jorhat)	Member
7.	Sri Jiten Pathori, Khakanguri, Jorhat. Rearer representative	Member
8.	Smt Sangiita Gogoi, Uttar Hatichungi, Jorhat, Assa, Reeler representative	Member
9.	Shri Moncy Issac, Deputy Secretary (Tech), Central Silk Board, Bangalore	Member
10.	Dr. S. N. Gogoi, Scientist - D & Incharge, RSRS, Jorhat , Assam	Member Convener
11.	Sri Sajal Kanti Das, Assistant Director (Sericulture), District Officer, HHS, Govt. Of Tripura, Dharmanagar	Member
12.	Sri Marsen Laso, Sericulture Research Officer, DOS, Meghalaya	Member
13.	Smt. Bornali Sur, Joint Director, DOS, Arunachal Pradesh	Member
14.	Sri Md. Hamidul Haque, Assistant Director (T), DOS, Manipur	Member
15.	Incharge, Regional Office, CSB, Guwahati, Assam	Member



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

Dr. (Mrs.) Kanika Trivedy, Director

MAIN INSTITUTE

- Dr. S.K.Dutta, Scientist-D, Mulberry Pathology Section [upto 30.04.2017, Retired]
- Dr. P. K.Ghosh, Scientist-D, MBG Section [upto 30.06.2017, Retired]
- Dr. Monica Chaudhuri, Scientist-D, Moriculture-I Division [upto 31.12.2017, Retired]
- Smt. Chandna Maji, Scientist-D, Training Division [Divisional Head, Training]
- Dr. Subhra Chanda, Scientist-D, Entomology Section [*Divisional Head, Sericulture* w.e.f 5.1.2018]
- Shri N. B. Kar, Scientist-D, Reeling & Spinning Division [Divisional Head, R & S]
- Dr. (Mrs.) Rita Banerjee, Scientist-D, MBG Section [upto 01.07.2017, Transferred]
- Dr. Lakshmanan Velusamy, Scientist-D, SBG Section
- Dr. S. Chattopadhyay, Scientist-D, Biotechnology Section/ Division [*Divisional Head, Biotechnology*]
- Dr. A. K. Verma, Scientist-D, Silkworm Breeding & Genetics Section
- Dr. Dipesh Pandit, Scientist-D, PMCE Division [Divisional Head, PMCE]
- Shri D. Chakravorty, Scientist-D, MBG Section [Divisional Head, Moriculture]
- Shri Zakir Hossain, Scientist-D, Silkworm Pathology Section
- Shri. Debojit Das, Scientist-D, Extension & Publicity Division [*Divisional Head*, *Extension & Publicity*]
- Shri Gopal Ch. Das, Scientist-D, Silkworm Physiology & RTI and BV Cell
- Dr. Sukhabrata Sarkar, Scientist-C, Training Division
- Dr. V. Vijay, Scientist- B, Agronomy & Soil Science Section
- Dr. Manjunatha, G. R, Scientist- B, PMCE Division
- Dr. R. Mahesh, Scientist- B, Agronomy & Soil Science Section
- Dr. Anil Pappachan, Scientist- B, Mulberry Pathology Section
- Dr. N. Chadrakanth, Scientist-B, SBG Section/ Silkworm Phy. & RTI and BV Cell
- Shri Suresh K. Scientist-B, MBG Section
- Shri K. Rahul Scientist-B, Silkworm Pathology Section
- Ms. Pooja Makwana, Scientist- B, Biotechnology Section/Dvn.
- Md. Safi Afroz, Scientist-B, Extension & Publicity Div.[study leave w.e.f. 31.01.2018]
- Shri S. Surendra Nath S, Deputy Director (A&A) [w.e.f. 24.07.2017]
- Shri Manas Kr. Roy, Assitant Director (A&A) [upto 31.12.2017, Retired]
- Shri P.K.Prasad , Assistant Director (Computer.)
- Shri Biswajit Halder, Assistant Director (A&A)
- Krishna Murthy, R., Assistant Director (A&A)
- Shri Sanatan Tiadi, Assistant Director (A&A)
- Shri Ram Briksh Choudhary, Assistant Director (OL)
- Shri G.R.V. Reddy, Assistant Executive Engineer

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REGIONAL SERICULTURAL RESEARCH STATION (RSRS)

- Dr. Ranjit Kar, Scientist-D, RSRS Kalimpong, West Bengal [In-charge]
- Dr. K. C. Brahma, Scientist-D, RSRS Koraput, Odisha [In-charge]
- Shri S.K.Misro, Scientist-C, RSRS Koraput
- Dr. S. N. Gogoi, Scientist-D, RSRS Jorhat, Assam [In-charge]
- Dr. U. C. Baruah, Scientist-D, RSRS Jorhat
- Smt. Mina Pamegam, Scientist-C, RSRS Jorhat

RESEARCH EXTENSION CENTRES (REC)

- Dr. T. Dutta (Biswas), Scientist- D, <u>REC Kamnagar</u>, Murshidabad, West Bengal [Incharge]
- Dr. Satadal Chakrabarty, Scientist-C, <u>REC Mothabari</u>, Malda, **West Bengal** [Incharge w.e.f. 02.06.2017]
- Md. Anwarul Haque, Technical Assistant, <u>REC, M.P. Raj</u>, Jharkhand [In-charge]
- Dr. G. S. Singh, Scientist-D , <u>REC, Bhandra</u>, Jharkhand [In-charge]
- Shri S.T.Lepcha, Scientist-D, <u>REC, Mamring</u>, **Sikkim** (REC, Rangpo shifted at Mamring dt.01.06.2017) [In-charge]
- Shri Satyabrata Dey, Scientist-C, <u>REC, Dhenkikote</u>, Odisha [In-charge]
- Dr. Reeta Luikham, Scientist-D, <u>REC</u>, Imphal, **Manipur** [In-charge]
- Dr. L. Somen Singh, Scientist-D, REC, Imphal, Manipur
- Dr. A. Borah, Scientist-D, <u>REC, Dimapur</u>, **Nagaland** [In-charge upto 28.02.2018, Retired]
- Shri Intimokchung, Technical Assistant, REC, Dimapur, **Nagaland** [In-charge w.e.f. 01.03.2018]
- Shri. B. K. Basumatary, Scientist-D, <u>REC, Mongaldai</u>, Assam BTC [In-charge]
- Dr. C.Z. Renthlei, Scientist-C, <u>REC, Shillong</u>, Meghalaya [In-charge]
- Shri B. N. Chowdhury, Scientist-D, <u>REC, Aizwal</u>, **Mizoram** [In-charge upto 30.05.2017, Transferred]
- Dr. L. Pachuau, Scientist-C, REC, Aizwal, Mizoram [In-charge w.e.f 01.06.2017]
- Shri. Subedar Pertin, Technical Assistant<u>. REC, Sille</u> [REC, Balijan shifted at Sille dt.16.08.2017], **Arunachal Pradesh** [In-charge]

26. SPECIAL ACTIVITIES ON WOMEN EMPOWERMENT, DEVELOPMENT OF SC/ST OR PEOPLE BELOW POVERTY LINE

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

26.A. MAIN INSITUTE

26.A.1.Details of SC/ST candidates participated in various training programme during 2017-18

	Category									Grand	
#			Male					Female	•		Total
	Gen.	SC	ST	OBC	Total	Gen.	SC	ST	OBC	Total	
1.	Post G	raduate	Diplom	a in Seri	iculture (15 mont	hs) 201	6-17			
	2	1	0	0	3	0	0	10	0	10	13
2.	Post G	raduate	Diplom	a in Seri	iculture (15 mont	hs) 201	7-18			
	5	0	4	0	9	2	1	5	3	11	20
3.	Farmer	s Skill T	raining	(5-10 da	ays)						
	12	31	24	39	106	36	99	67	134	336	442
4.	Techno	logy Or	ientatio	n Progra	amme						
	17	28	9	27	81	24	22	15	42	103	184
5.	Manage	ement D	Developi	ment Pro	ogramme)					
	14	7	2	13	36	9	21	22	15	67	103
6.	Awaren	iess Tra	aining Pi	rogramn	ne for Bił	nar (3 da	iys)				
	7	78	52	119	256	58	159	72	192	481	737
7.	Awaren	iess Tra	aining Pi	rogramn	ne for Utt	ar Prade	esh (3 d	ays)			
	0	0	0	0	0	0	2	5	2	9	09
8.	Awaren	iess Tra	aining Pi	rogramn	ne for W.	B. (1 da	ay)				
	42	13	6	8	69	17	8	0	7	32	101
9.	Exposu	re visit	under T	echnolo	gy Aware	eness P	rogram	me for N	VE state	<u>s (2-3 c</u>	lays)
	51	83	93	6	233	89	156	101	43	389	622
10.	Intensiv	/e Train	ing								
	2	0	7	4	13	4	2	82	12	100	113
11.	Seri Re	source	Centre	(1 day)							
	295	19	22	116	452	482	39	6	256	783	1235
Total	447	260	219	332	1258	721	509	385	706	2321	3579

26.B. NESTED UNITS

26.B. 1. RSRS, JORHAT, ASSAM

- 1. Women play a vital role in the development of mulberry sericulture industry. To increase their income, their development & their empowerment, RSRS, Jorhat and its RECs have conducted training programs for women (80-90%) especially for SC/ST/below poverty line under Chawki rearing training & farmers training programmes in NE states. They were trained in latest technologies of chawki silkworm rearing.
- 2. In all the north eastern states, almost all the beneficiaries (90-95%) are tribal women below poverty line. The extension communication programme helps them to take up one more rearing during the year with Bivoltine hybrid rearing and enhancing their annual income up to 10 %.
- 3. Under BV CPP 99% of the beneficiaries are belonged to ST/SC in Manipur, Nagaland, Mizoram and BTC (Assam). Out of that, 95% of them are women beneficiaries of below poverty line group.

27. MISCELLANEOUS EVENTS/ACTIVITIES IF ANY: 27.A. MAIN INSTITUTE

27.A.1. Radio and Television programmes attended / sponsored by the institute during the year 2017-18.

#	Radio/TV/FM/	Date and	Dura-	Торіс	Name and Designation	Spon-
	Cable Prog.	Time	tion	Discussed	of the Scientist(s) /	sored/
	(specific slot		(Min)		official(s) attended the	invited
	/channel name)				prog.	
1	All India	11.07.17	15	Disease and	Mr. Zakir Hossain	Spon-
	Radio (AIR)-	06.40 pm		pest	Sci-D,SWP Section	sored
	Kolkata	"Resham		manage-	CSR&TI, B'pore	
	West Bengal	Katha''		ment of	-	
2	All India	18.07.17	15	Improved	Dr.T.Datta Biswas	-do-
	Radio (AIR)-	06.40 pm		Silkworm	Sci-D, Extn Divn.	
	Kolkata	"Resham		Rearing	CSR&TI, B'pore	
	West Bengal	Katha''		_	_	
3	All India	25.07.17	15	Mulberry	Mr. D.Das	-do-
	Radio (AIR)-	08:15 PM		Cultivation	Sci-D, Extn Divn.	
	Kolkata	"Resham			CSR&TI, B'pore	
	West Bengal	Katha''			_	
4	All India	05.03.18	15	Disease and	Dr. D.P.Das Mahapatra	-do-
	Radio (AIR)-	06.40 pm		pest	Sci-C,	
	Cuttack	"Resham		management	RSRS, Koraput, Odisha	
	ODISHA	Katha"		of mulberry		
5.	All India	12.03.18	15	and		-do-
	Radio (AIR)-	06.40 pm		silkworm,		
	Cuttack	"Resham		Improved		
	ODISHA	Katha"		Silkworm		
6	All India	19.03.18	15	Rearing &		-do-
	Radio (AIR)-	06.40 pm		Mulberry		
	Cuttack	"Resham		Cultivation		
	ODISHA	Katha''				
7	All India	04 12 17	15	Disease and	Dr. L. Somen Singh	-do-
	Radio (AIR)-	06.40 pm	10	pest	Sci- D. REC. Imphal.	40
	Imphal	"Resham		manage-	Manipur	
	Manipur	Katha"		ment of	1. In the second se	
0	All India	11 12 17	15	mulberry		da
8	All India	11.12.17	15	and		-00-
	Kaulo (AIK)-	00.40 pm		silkworm,		
	Impnai Moningg	Kesnam Vatha"		Improved		
	manipur	Naula		Silkworm		
				Rearing &		

#	Radio/TV/FM/	Date and	Dura-	Topic	Name and Designation	Spon-
	Cable Prog.	Time	tion	Discussed	of the Scientist(s) /	sored/
	(specific slot		(Min)		official(s) attended the	invited
	/channel name)		Ì Í		prog.	
9	All India	18.12.17	15	Mulberry	Dr. L.Somen Singh,	Spon-
	Radio (AIR)-	06.40pm		Cultivation	Sci- D, REC, Imphal,	sored
	Imphal	"Resham			Manipur	
	Manipur	Katha"			-	
10	All India	01.03.18	15	Disease and	Dr.S.N.Gogoi	-do-
	Radio (AIR)-	06.40 pm		pest	Sci- D, RSRS, Jorhat,	
	Guwahati	"Resham		management	Assam	
	Assam	Katha''		of mulberry		
11	All India	08.03.18	15	and silkworm,		-do-
	Radio (AIR)-	06.40 pm		Improved		
	Guwahati	"Resham		Silkworm		
	Assam	Katha"		Rearing &		
12.	All India	15.03.18	15	Mulberry		-do-
	Radio (AIR)-	06.40 pm	_	Cultivation		
	Guwahati	"Resham				
	Assam	Katha"				
13	All India	06.03.18	15	Disease and	Dr.L.Pachuau	-do-
	Radio (AIR)-	06.40 pm		pest	Sci-C, REC, Aizwal,	
	Aizwal,	"Resham		management	Mizoram	
	Mizoram	Katha''		of mulberry		
14	All India	13.03.18	15	and silkworm,		-do-
	Radio (AIR)-	06.40 pm		Improved		
	Aizwal,	"Resham		Silkworm		
	Mizoram	Katha"		Rearing &		
15.	All India	20.03.18	15	Mulberry		-do-
	Radio (AIR)-	06.40 pm		Cultivation		
	Aizwal,	"Resham				
	Mizoram	Katha"				
16.	All India	04.03.18	15	Disease and	Dr. C.Z.Renthlei	-do-
	Radio (AIR)-	06.40 pm		pest	Scientist C,	
	Shillong,	"Resham		management	REC, Shillong	
	Meghalaya	Katha"		of mulberry		
17.	All India	11.03.18	15	and silkworm,		-do-
	Radio (AIR)-	06.40 pm		Improved		
	Shillong,	"Resham		Silkworm		
L	Meghalaya	Katha"		Rearing &		
18.	All India	18.03.18	15	Mulberry		-do-
	Radio (AIR)-	06.40 pm		Cultivation		
	Shillong,	"Resham				
	Meghalaya	Katha''				

#	Radio/TV/FM/	Date and	Dura-	Topic	Name and	Spon-
	Cable Prog.	Time	tion	Discussed	Designation of the	sored/
	(specific slot		(Min)		<pre>Scientist(s) / official(s)</pre>	invited
	/channel name)				attended the prog.	
19	All India Radio	07.03.18	15	Disease and	Dr.G.S.Singh	Spon-
	(AIR)- Ranchi,	06.40 pm		pest	Sci- D,REC, Bhandra,	sored
	Jharkhand	"Resham		management	Jharkhand	
		Katha"		of mulberry		
20	All India Radio	14.03.18	15	and silkworm,		-do-
	(AIR)- Ranchi,	06.40 pm		Improved		
	Jharkhand	"Resham		Silkworm		
		Katha"		Rearing &		
21	All India Radio	21.03.18	15	Mulberry		-do-
	(AIR)- Ranchi,	06.40 pm		Cultivation		
	Jharkhand	"Resham				
		Katha"				
22.	All India Radio	03.03.18	15	Disease and	Dr. S.T. Lepcha	-do-
	(AIR)- Kurseong,	06.40 pm		pest	Sci-D,REC,	
	West Bengal	"Resham		management	Mamring, Sikkim	
		Katha"		of mulberry		
23	All India Radio	10.03.18	15	and silkworm,		-do-
	(AIR)- Kurseong,	06.40 pm		Improved		
	West Bengal	"Resham		Silkworm		
		Katha"		Rearing &		
24	All India Radio	17.03.18	15	Mulberry		-do-
	(AIR)- Kurseong,	06.40 pm		Cultivation		
	West Bengal	"Resham				
		Katha"				
		TO	TAL=	24 Episode		

27.A.2.Video Film produced for telecasting in TV during the year 2017-18

#	Title of the documentary film	Duration
1	Tour in CSR&TI	10.0 Minutes
2	History of Murshidabad Silk & the Institute	10.0 Minutes
3	Preparation of Mulberry Nursery & Mulberry Variety	18.0 Minutes
4	Tunte gacher pradhan khatikarak poka o pratikar	21.0 Minutes
5	Training Activities of CSR&TI, Berhampore, W.B.	09.0 Minutes
6	Soil Testing & Recommendation	09.5 Minutes
7	Proper disinfection of rearing room & silkworm bed	10.0 Minutes
8	Mulberry Disease Management	08.0 Minutes

27.A.3.GUEST LECTURES:

On monthly basis the Institute arranged the following **guest lectures** by the eminent personalities like Scientists, Professors, Doctors, etc. on their specialization, for updating/ adding knowledge and skills to Institute personals.

- 1. Sucking Pest of Mulberry: Identifying challenges and research needs Dr. Shantanu Jha, Professor and Head, Dept. of Agriculture Entomology, BCKV, Mohanpur (25.04.2017).
- 2. Mechanization in crop cultivation Dr. J P Gupta Professor & Dean Faculty of Agriculture Engineering, BCKV, Mohanpur (12.05.2017).
- 3. Silk based materials for biomedical appliance- Dr. Sayam Sen Gupta, Associate Professor, Dept. of Chemical Sciences, IISER, Kolkata (08.06.2017).
- 4. Implementation of Goods & Services Taxes (GST) Shri Goutam Das Gupta, Asst. Director, NACEN, Kolkata (15.06.2017).
- 5. **Safety and Security -** Shri Jibanesh Roy, DSP, Berhampore, Murshidabad, West Bengal (22.7.2017).
- 6. Civil defence and civil rules Shri. Mukesh Kumar, IPS, Superintendent of Police, Berhampore, Murshidabad, West Bengal (16.08.2017).
- 7. Implementation of GST and GeM Mr. Goutam Das Gupta, Asst. Director, NACEN, Kolkata (25.08.2017).
- 8. Mass production and use of egg parasitoid trichogramma Dr. S. M. A. Mandal, Associate Professor, Entomology, CA, Orissa University of Agriculture and Technology (OUAT), Bhubaneswar (25.09.2017).
- 9. Mass Communication Shri Amartya Saha, Asst. Professor, New Alipore College, Kolkata (20.10.2017).
- 10. Acupressure The Naturopathy Shri Tapas Ghosh, Lecturer, Healthy India, Uttarpara, Hooghly (20.11.2017).
- 11. **Banking Awareness & Multi Retail Products** Shri Dibyendu Bhattacharya, Regional Manager, SBI, Berhampore (18.12.2017).
- 12. Eye care Shri Nibir Pradhan, Optometrist, Berhampore (27.01.2018)
- 13.LIC plans/ schemes and their benefits Shri. T. K. Mitra, Sr. Branch Manager, LIC, Berhampore (26.02.2018).
- 14. **Waste to Wealth** Shri Paresh Nath Ball, Asst. Director of Agriculture Krishi Bhavan, Berhampore, Murshidabad (14.03.2018).

27.B.NESTED UNITS

27.B.1. RSRS, JORHAT

Swacchhata Pakowada: RSRS, Jorhat and 6 REC units have observed the "Swacchhata Pakowada" from 01.05.2017 to 15.05.2017 with cleanness drives, Awareness

camps etc. **Swachhta Hi Sewa** fortnight from 15th Sept., 2017 to 2nd Oct., 2017 with various events were observed at the Station.

Vigillance Awareness Week observed from 30.10.2017 to 04.11.2017 to bring awareness against corruption in public life and ways and means to eradicate the same



to make the country corruption free. On first day of week, Dr. S.N. Gogoi, Sci-D administered the oath to the office staff both in Hindi and English. During the week, interactions were held daily among the employees and subsequent discussion/ interaction, oral presentation on ways and means of vigilance on work place, and placing banner in different locations. The week was ended with

valedictory function. Sadbhavana Diwas was observed on 19th Sept., 2017.

Observance of Birthday of Dr. Bhimrao Ambedkar was observed on 14.04.2017. During the programme Digital & Cashless transaction, downloading and use of BHIM app was demonstrated to the audience. The officer & staff along with the SFW's of RSRS, Jorhat and local Women sericulturists were attended the programme.



PMCE DIVISION:

Major Activities:

- ✓ Monitoring, co-ordination and evaluation of ongoing, concluded and new research projects / programmes/ pilot studies of Main Institute and RSRSs.
- ✓ Organization and compilation of scientific / technical reports (e.g. agenda explanatory note, progress of ongoing, concluded research projects/ programmes/ pilot studies and follow up actions) of the following meetings.
 - (a) Research Council Meeting [2 times per annum]
 - (b) Research Advisory Committee Meeting [2 times per annum]
 - (c) Video conference meeting {as and when required]
- ✓ Preparation and compilation of Annual Action Plan of the Institute and its nested units.



- ✓ Implementation of RFD of Institute & nested units and progress submission to CSB: Preparation of RFD Action plan for the next year. Preparation and submission of RFD of the Scientists and allied staff of the Institute & nested units. Preparation of RFD reports and submission on Quarterly basis. Preparation and submission of results of RFD for the year.
- ✓ Establish documents, implement and maintain a quality management system and continually improve its effectiveness in accordance with the requirements of the international standard by **Implementing of ISO 9001 2015 at the Institute.**
- ✓ Preparation and compilation of Annual Research and Administrative Reports of the Institute and its nested units.
- ✓ Preparation of the Report of the Institute for CSB's Annual Report.
- ✓ Preparation and compilation of Monthly, Quarterly and Yearly Reports on progress of Research Projects, Programmes and Pilot Studies of Main Institute and RSRSs besides correspondences and co-ordination with Central Office on scientific & technical matters.
- ✓ Preparation of follow-up action of RCC, RRAC, AICEM etc. for presentation in the meetings.
- ✓ Correspondences and coordination with universities / institutes/ other organizations for collaborative research projects/programmes.
- \checkmark Co-ordination and correspondences to DOSs of different states and other organizations.
- ✓ Correspondences with other organizations regarding 'Patenting' and 'Commercialization of evolved technologies, products and processes'.
- ✓ Maintenance of files related to Right-to-Information Act (Updating of different information for websites), preparation of monthly and quarterly reports and disposal of RTI related appeals of the information's seekers.
- ✓ Maintenance and correspondences of subject related to about One hundred and seventeen (117) files and registers (e.g. Publication, Consultancy, Store article, Dead Stock articles etc.).
- ✓ Preparation and compilation of all different kinds of miscellaneous reports of the Institute and its nested units as and when required.
- ✓ Organizing other regular internal and external meeting as well and ensuring proper follow up.
- ✓ Apart from above activities, the scientists of PMCE division also taken up /associated with the projects/programmes [MTS 3599, MOT 3601, PPF 3585, MOE 3604, BPR (RP) 022 and B-PRP(P) 45] as P.I/ Co.I.

28. METEOROLOGICAL DATA

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

Data taken from meteorological surface observatory installed by India Meteorological Department (IMD) / Regional Meteorological Centre, Kolkata-700 027 in the campus of CSR&TI, Berhampore for daily recording and transmission of meteorological data at 3.30 GMT (08.30 AM) and 12.30 GMT (05.30 PM).

Month	nth Temperature (°C)		Relative Hu	umidity (%)	Rainfall	Rainy	Avg. Wind	Avg. Bright	Avg.
	Max	Min	Max	Min	(mm)	days	velocity	sunshine	Evaporation
						(No)	(kmph)	(hrs)	(mm/hr)
Apr.,17	40.40	18.20	95.00	49.00	25.00	2.00	4.83	6.33	5.74
May,17	35.60	23.60	86.00	74.00	95.00	9.00	3.63	5.00	4.10
Jun.,17	37.20	21.80	98.00	49.00	144.00	6.00	3.86	6.07	6.57
Jul.,17	38.20	25.00	100.00	71.00	277.00	15.00	3.50	4.28	4.12
Aug., 17	37.80	25.20	98.00	66.00	173.00	9.00	3.27	4.90	4.60
Sept, 17	37.40	24.60	95.00	66.00	71.00	11.00	2.81	4.62	3.17
Oct., 17	36.20	20.20	95.00	61.00	157.00	10.00	3.08	4.95	2.01
Nov., 17	32.60	12.40	97.00	60.00	3.00	0.00	1.94	7.48	2.52
Dec., 17	28.00	11.00	98.00	55.00	21.00	2.00	2.46	5.90	1.40
Jan.,18	27.20	6.00	94.00	33.00	0.00	0.00	2.51	4.22	1.49
Feb., 18	33.20	10.40	92.00	54.00	6.00	1.00	2.34	6.20	2.01
Mar.,18	37.20	16.20	93.00	37.00	0.00	0.00	3.18	5.78	3.89
	40.40	6.00	100.00	33.00	972.00	65.00	3.12	5.48	3.47

28.II. REGIONAL SERICULTURAL RESEARCH STATION (RSRS): A. KALIMPONG, WEST BENGAL

Meteorological data on Temp., Relative Humidity & Rainfall at RSRS farm

Month	Tempera	ature (°C)	Relative Humidity (%)		Rainfall (mm)	Rainy days (no.)
	Max	Min	Max	Min		
Apr.,17	30	14	100	19	71.6	09
May,17	32	14	100	37	30.3	13
Jun.,17						
Jul.,17	Could not be recorded due to prolonged unrest situation in this hilly region				nilly region	
Aug., 17						
Sept, 17	34	19	100	39	50.70	18
Oct., 17	33	14	100	29	07.00	08
Nov., 17	29	12	99	26	00.20	01
Dec., 17	27	10	99	19	00.00	00
Jan.,18	24	06	98	26	00.20	01
Feb., 18	26	07	98	26	01.70	01
Mar.,18	28	12	98	29	09.20	08
	34	6.00	100	19	18.99	143

This station is situated at an elevation of 950 mts above MSL (Longitude 89°59" to 88°53" and Latitude between 26°31" to 27°13") under the sub-Himalayan belt.

Temperature varies from 5°C to 35°C, relative humidity varies from 30% to 99 % and rainfall range from 1600 to 2500 mm with range of 96 to 110 number of rainy days. Soil is sandy-loam, rich in mica and pH ranges between 4.5 and 6.5.

B. KORAPUT, ODISHA

Meteorological data on Temperature, Relative humidity & Rainfall at RSRS farm

Month & Year	Year Temperature (°C)		Relative H	umidity (%)	Rainfall	
	Max.	Min.	Max.	Min.	mm	days
Apr.,17	36.00	22.00	76.00	19.00	17.20	03
May,17	39.00	19.00	78.00	33.00	60.10	08
Jun.,17	35.00	21.00	95.00	39.00	200.20	19
Jul.,17	29.00	21.00	100.00	57.00	464.00	21
Aug., 17	29.00	20.00	91.00	45.00	242.50	19
Sept, 17	29.00	22.00	92.00	73.00	147.30	13
Oct., 17	28.00	15.00	100.00	41.00	234.90	13
Nov., 17	26.00	13.00	96.00	47.00	19.70	01
Dec., 17	25.50	10.00	90.00	50.00	00.00	00
Jan.,18	25.00	10.00	90.00	30.00	00.00	00
Feb., 18	30.00	12.00	90.00	22.00	00.00	00
Mar.,18	34.00	17.00	84.00	29.00	11.00	01
	39.00	10.00	100.00	19.00	1396.90	98

C. JORHAT, ASSAM

Meteorological data on Temperature, Relative humidity & Rainfall at RSRS farm:

1	Location	In the eastern part of Assam state of India	
2	2 Latitude-Longitude 26°45'N 94°13'E / 26.75°N 94.22°E		
3	Elevation	116 m (381 ft)	
4	Climate	Semi- Arid	
5	Avg. annual temperature	25 °C (77 °F)	
	Summer temperature	23 - 39 °C	
	Winter temperature	31 - 8 °C	

Date	Temperature (° C)		Relative Humidity (%)		Rainfall
	Max.	Min.	Max.	Min.	(mm)
Apr., 2017	33	19	99	26	273
May, 2017	31	20	99	44	210
Jun., 2017	37	23	99	39	242
Jul., 2017	35	22	99	42	523
Aug., 2017	36	24	99	45	208
Sept., 2017	36	23	99	47	288
Oct., 2017	36	19	99	41	241
Nov., 2017	32	11	99	21	742
Dec., 2017	27	10	99	34	000
Jan., 2018	26	08	99	36	022
Feb., 2018	24	11	99	36	004
Mar., 2018	27	17	98	32	005
	37.00	08.00	99.00	21.00	2758

29. ADMINISTRATIVE & FINANCIAL REPORT

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

A. STAFF POSITION : MAIN INSTITUTE AND NESTED UNIT

Category	Sanctioned	Filled	Vacancy
Director	1	1	-
Scientific	80	38	42
Technical	149	115	34
Administrative	197	118	79
Total	= 427	272	155

B. OFFICERS & STAFF RETIRED / EXPIRED:

#	Name of employees	Designation	Date of retirement/ Expired*
1.	Dr.S.K.Dutta	Scientist -D	30.04.2017
2.	Shri Sunil Kr. Das	Driver	30.04.2017
3.	Shri Gobindo Debbarma	Multi Tasking Staff	30.04.2017
4.	Dr.P.K.Ghosh	Scientist -D	30.06.2017
5.	Shri Pravash Ch. Thakur	Technical Assistant	14.08.2017*
6.	Shri Pulak Kr. Mukherjee	Technical Assistant	31.10.2017
7.	Shri Nirmal Kr. Das	Senior Mechanic (SG)	30.11.2017
8.	Shri Amal Krishna Dutta	Assistant Superintendent	30.11.2017
9.	Shri Manas Kr. Roy	Assistant Director (A&A)	31.12.2017
10.	Dr. Monica Chaudhuri	Scientist -D	31.12.2017
11.	Shri Sanjib Kr. Roy	Technical Assistant	31.12.2017
12.	Md. Abu Bakkar Sk.	Multi Tasking Staff	31.12.2017
13.	Smt. Rita Majumder (Mitra)	Assistant Superintendent	31.01.2018
14.	Shri Samir Kr. Roy	Technical Assistant	31.01.2018
15.	Shri Subir Kr. Pal.	Technical Assistant	31.01.2018
16.	Shri Debasish Bhattacharya	Technical Assistant	31.01.2018
17.	Md. Kausar Ali	Upper Division Clerk	31.01.2018
18.	Shri Shyam Behari Ram	Senior Technical Assistant	31.01.2018
19.	Shri Manoranjan Dey	Multi Tasking Staff	31.01.2018
20.	Dr. Anukul Borah	Scientist - D	28.02.2018
21.	Shri Biswanath Das	Technician	31.03.2018

C. BUDGET (Rs. in lakh): (2017-18)

Non-Plan	Plan-Gen	Plan-Cap	NE		Total
			Gen	Сар	
3719.98	476.50	705.41	70.78	288.25	5260.98