CSRTI

वार्षिक प्रतिवेदन
ANNUAL REPORT
2022-2023



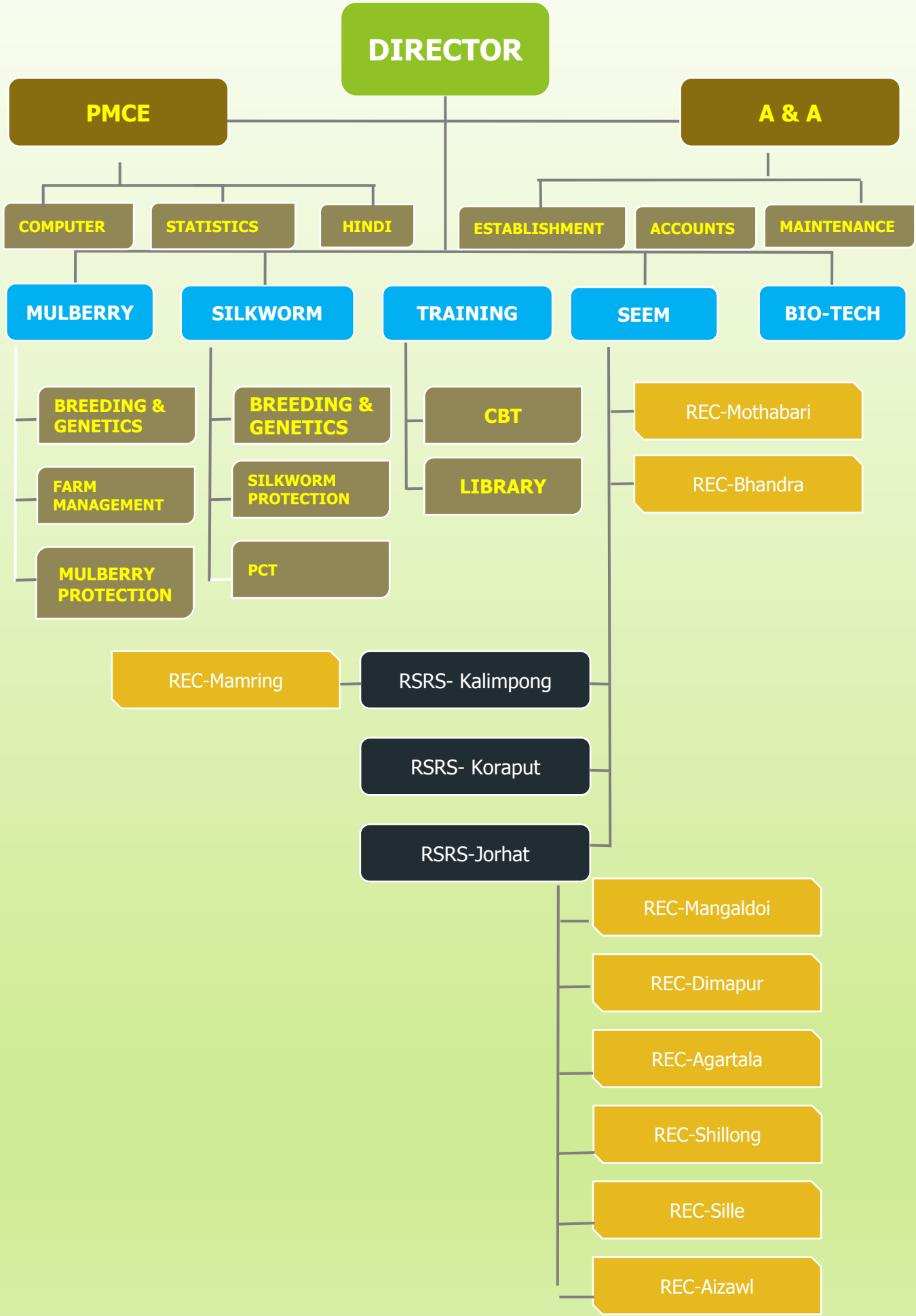


केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान
Central Sericulutral Research & Training Institute

केंद्रीय रेशम बोर्ड Central Silk Board, वस्त्र मंत्रालय Ministry of Textiles

भारत सरकार Govt. of India, बहरमपुर Berhampore742101

पश्चिम बंगाल West Bengal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निदेशक, केरेउअप्रसं-बहरमपुर

Published by
Dr. Kishor Kumar, C.M.
Director, CSRTI- Berhampore

संपादकीय समिति
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हिन्दी अनुवाद
श्री चंदन कुमार साव

Hindi Translation
Shri Chandan Kr. Shaw

मुख्य पृष्ठ सज्जा
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Cover Page Design & DTP
Dr. Kishor Kumar, C.M.
Dr. Dipesh Pandit

प्रतियां: 100

Copies: 100

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प्रस्तावना

केंद्रीय रेशम बोर्ड के तत्वावधान में केरेउअवप्रसं, बहरमपुर पूर्वी तथा उत्तर पूर्वी क्षेत्रों में अग्रणी रेशम उत्पादन संस्थान है। संस्थान अनुसंधान एवं विकासात्मक सुविधाओं के माध्यम से उन्नत रेशमकीट नस्लों, उच्च उपज देने वाली शहतूत प्रजातियों का प्रचार-प्रसार करने के साथ ही साथ, शहतूत कृषि एवं सुधार, रेशमकीट सुधार एवं उत्पादन, रेशमकीट तथा परपोषी पौधों को कीटों व बीमारियों से बचाने एवं शहतूत रेशम उत्पादन के लिए आवश्यक दिशानिर्देश प्रदान करने से संबंधित वर्तमान में विकसित प्रौद्योगिकियों का प्रदर्शन करते आ रहा है। संस्थान पांच पूर्वी तथा आठ उत्तर पूर्वी राज्यों में अपनी अधीनस्थ इकाइयों (3 क्षेरेउअके एवं 9 अविके) के माध्यम से 13 राज्यों को सम्मिलित कर अनुसंधान व प्रचार-प्रसार का कार्य करते आ रहा है।

स्थलाकृति एवं कृषि-जलवायु विविधताओं के कारण इस क्षेत्र में रेशम उत्पादन अद्वितीय है। केरेउअवप्रसं, बहरमपुर सतत उत्पादन सुनिश्चित करने वाले कृषकों के प्रक्षेत्र से संबंधित विभिन्न समस्याओं को हल करने का प्रयास करते आ रहे है। ओएसटी तथा ओएफटी दोनों में परियोजना मोड में प्रौद्योगिकियों के परीक्षण के कार्यान्वयन के माध्यम से "**प्रयोगशाला से प्रक्षेत्र**" कार्यक्रम पर बल दिया गया है।

संस्थान में वर्ष के दौरान, संस्थान की 16 परियोजनाए एवं 6 सहयोगी परियोजनाए आरंभ की गई। इनमें से तीन नाबार्ड, डीएसटी-जेएसपीएस और डीबीटी द्वारा वित्त पोषित परियोजनाएं हैं। रिपोर्टाधीन अवधि के दौरान 2 परियोजनाएं सम्पन्न की गई। रेशमकीट सुधार प्रभाग के अंतर्गत गुणवत्तापूर्ण वाणिज्यिक रेशमकीट बीज उत्पादन को बढ़ाने हेतु संस्थान द्वारा पश्चिम बंगाल में बीज फसल उत्पादकता में सुधार पर परियोजना के माध्यम से आशाजनक आरंभ की गई। प्राधिकरण परीक्षणों के तहत एक नई उत्पादक संकर 12Y x BFC1 का कुल औसत कोसा उत्पादन [एन × (एसके6 × एसके7)] 40.28 किग्रा/100 रोमुच नियंत्रण की अपेक्षा 45.3 किग्रा/100 रोमुच इस क्षेत्र में बहुत आशाजनक पाया गया। इस उत्कृष्ट अवलोकन के लिए केंद्रीय रेशम बोर्ड के सक्षम प्राधिकारी ने वाणिज्यिक समुपयोजन हेतु 12Y x BFC1 को अधिकृत किया है। ठीक इसी प्रकार, कवच अवयव (>19%) एवं उत्तरजीविता (>85%) के आधार पर, तीन फाउंडेशन क्रॉस अर्थात् एनएफसी11(पी) x एनएफसी18(पी), एनएफसी19(डी) x एनएफसीआर(डी) एवं एनएफसी18 (एम) x एनएफसी12 (एम) को आगे के परीक्षण के लिए संभावित मेल घटकों के रूप में चिन्हित किया गया है।

शहतूत सुधार खंड के तहत, एक नए शहतूत जीनोटाइप सी-9 ने वर्षाश्रित लाल लेटराइट मिट्टी (12%) के तहत सी-2038 की तुलना में उच्च औसत मौसमी पत्ती उत्पादकता दर्ज की। सी-2038 के लिए अंतराल एवं पोषक तत्वों की खुराक पर एक अध्ययन से पता चला कि उर्वरक की 120% अनुशंसित खुराक के साथ 2'×2' अंतराल से नियंत्रण (59.52 टन/हेक्टेयर/वर्ष) की तुलना में 15.1% अधिक पत्ती उपज (68.5 टन/हेक्टेयर/वर्ष) दर्ज की गई। एस-1635 एवं सी-2038 सूत्रीकरण एसएनपी, बीएपी तथा बीएपी+एए के साथ छिड़काव करने से पत्ती की सेनेसेंस में क्रमशः 36.3%, 35.2% और 35.8% की कमी दर्ज की गई। एक अन्य अध्ययन में, चूर्णील अशिता की संवेदनशीलता में शामिल दो जीन MLO2 एवं MLO6A की पहचान की गई, जिनका उपयोग चूर्णील अशिता शहतूत किस्मों के विकास के लिए किया जाएगा।

क्लस्टर संवर्धन कार्यक्रम (सीपीपी) के तहत, आठ मेगा क्लस्टर (पश्चिम बंगाल में मालदा एवं मुर्शिदाबाद; मणिपुर-मैदानी क्षेत्र तथा मणिपुर-पहाड़ी; असम-निचला एवं असम-ऊपरी; मिजोरम में आइजोल; पश्चिम त्रिपुरा) द्वारा 851.14 टन कोसा का उत्पादन दर्ज किया गया तथा पूर्वी तथा उत्तर-पूर्वी भारत में अनुमानित कच्चे रेशम

का उत्पादन 162.31 टन (78.40%) (द्विप्रज: 75.63 टन और आईसीबी: 86.68 टन) दर्ज की गई। मुर्शिदाबाद जिले में रेशम - व्यापार उद्यमों के रूप में स्थापित दो चाकी पालन केंद्रों (सीआरसी) द्वारा लाभार्थी को लगभग 8 किलोग्राम/100 रोमुच के महत्वपूर्ण उपज लाभ के साथ 50 किलोग्राम/100 रोमुच कोसा का उत्पादन दर्ज किया गया जबकि गैर-लाभार्थी कृषकों द्वारा 42 किलोग्राम कोसा का उत्पादन दर्ज किया गया।

संस्थान द्वारा क्षेत्र में मानव संसाधन विकास में भी महत्वपूर्ण भूमिका निभाई एवं कुल 3558 कृषकों को "संरचित" तथा "गैर-संरचित" पाठ्यक्रमों के माध्यम से प्रशिक्षित किया गया। इस अवधि के दौरान, किसान क्षेत्र दिवस, जागरूकता/प्रबोधन कार्यक्रम, प्रौद्योगिकी प्रदर्शन, रेशम कृषि मेला, कार्यशालाएं/सेमिनार आदि के रूप में 121 विस्तार कार्यक्रम आयोजित किए गए। प्रौद्योगिकी प्रदर्शन, रेशम कृषि मेला, कार्यशालाएं/सेमिनार आदि आयोजित किए गए और 7422 से अधिक कृषकों/रेशम -हितधारकों को विभिन्न रेशम उत्पादन प्रौद्योगिकियों पर प्रशिक्षित किया गया।

मुझे यह अवगत कराते हुए हर्ष का बोध हो रहा है कि संस्थान राजभाषा (हिंदी) के कार्यान्वयन में भी अग्रणी है। इसी क्रम में, वर्ष 2020-21 के लिए केरेउअवप्रसं, बहरमपुर को भारत के पूर्वी तथा उत्तर पूर्वी राज्यों के पुरस्कार समारोह में दिनांक 08.12.2022 को भुवनेश्वर, ओडिशा में आयोजित क्षेत्रीय राजभाषा सम्मेलन के दौरान तृतीय पुरस्कार से सम्मानित किया गया।

अधोहस्ताक्षरी, अनुसंधान सलाहकार समिति (आरएसी) एवं अनुसंधान समन्वय समिति (आरसीसी) के अध्यक्ष एवं सदस्यों को उनके बहुमूल्य मार्गदर्शन के लिए, सदस्य सचिव, केरेबो, बेंगलुरु को प्रशासन तथा केरेउअवप्रसं, बहरमपुर के सभी अनुसंधान प्रयासों को प्राप्त करने के लिए तकनीकी सहायता हेतु निदेशक (तकनीकी) एवं आरसीएस, केरेबो, बेंगलुरु के सहयोग के लिए हार्दिक आभार व्यक्त करते हैं। इसी प्रकार पूर्व एवं पूर्वोत्तर भारत के सभी राज्यों के रेशम उत्पादन विभागों के प्रति भी आभार प्रकट करता हूँ।

अंतत:, मैं निर्धारित लक्ष्यों को प्राप्त करने हेतु उनके निरंतर प्रयासों तथा और मूल्यवान योगदान के लिए अधीनस्थ इकाइयों एवं सभी वाह्य वित्त पोषित एजेंसियों (डीबीटी, डीएसटी और नाबार्ड) सहित संस्थान के वैज्ञानिकों, तकनीकी, प्रशासनिक कर्मचारियों की टीम को बधाई देना चाहता हूं।

[डॉ. किशोर कुमार, सी. एम.]
निदेशक

FOREWORD

CSRTI Berhampore under the aegis of Central Silk Board is the leading sericulture institute in Eastern & North Eastern regions having R&D facility which develops and deploys improved silkworm breeds, high yielding mulberry varieties, demonstrating the recent developed technologies related to mulberry cultivation & improvement, silkworm improvement & production, silkworm & host plant protection from pests & diseases and providing necessary guidelines to mulberry sericulture farmers covering 13 states through its nested units (3 RSRSs & 9 RECs) across five Eastern and eight North Eastern states.

Sericulture is unique in this region due to topography and agro-climatic variations. CSRTI, Berhampore is striving to solve different issues related to farmers' fields ensuring sustainable silk production. Emphasis has been laid for a strong "**lab-to-land**" programme through implementation of transfer of technologies in project mode both in OST and OFT.

During the year, 16 own projects (PI) and 6 collaborative projects (CI) have been pursued at the CSRTI, Berhampore. Among them three are externanal projects funded by NABARD, DST-JSPS and DBT. 2 projects were concluded during the period under report. Under silkworm improvement division, for augmentation of quality commercial silkworm seed production, a promising ingenuity initiated through a project on improvement of Seed crop productivity in West Bengal by the institute. A new productive cross breed 12Y x BFC1, under authorization trials found very promising in the region with an overall average cocoon production of 45.3 kg/ 100 dfls against control [N × (SK6 × SK7)] of 40.28 kg/ 100 dfls. For this outstanding observation competent authority of Central Silk Board has authorized 12Y x BFC1 for commercial exploitation. Similarly, based on the shell content (>19%) and survival (>85%), three Foundation Crosses namely NFC11(P) x NFC18(P), NFC19(D) x NFCR(D) and NFC18(M) x NFC12(M) were identified as potential male components for further testing.

Under Mulberry improvement segment, a new mulberry genotype C-9 recorded higher mean seasonal leaf productivity over C-2038 under rainfed red laterite soils (12%). A study on spacing and nutrient dose for C-2038 revealed 2'×2' spacing with 120% Recommended Dose of Fertilizer recorded 15.1 % higher leaf yield (68.5 t/ha/yr) over control (59.52 t/ha/yr). S-1635 & C-2038 sprayed with the formulation SNP, BAP & BAP+AA reduced the leaf senescense by 36.3%, 35.2% & 35.8%, respectively. In another study, identified two candidate genes MLO2 and MLO6A involved in powdery mildew susceptibility which would be exploited for development of mildew resistant mulberry varieties.

Under Cluster Promotion Programme (CPP), eight mega clusters (Malda and Murshidabad in West Bengal; Manipur-Plain and Manipur-Hill; Assam-Lower and Assam-Upper; Aizawl in Mizoram; West Tripura) have produced 851.14 tons of cocoons and recorded 162.31 tons (78.40%) of estimated raw silk production (BV: 75.63 tons & ICB: 86.68 tons in Eastern & North-Eastern India. Two chawki rearing centers (CRCs) in Murshidabad district established as seri-business enterprises have yielded cocoon of about 50 kg/100 dfls to the beneficiary where as 42 kg to non-beneficiary, with a significant yield benefit of about 8 kg/100dfls.

The Institute also played significant role in Human Resource Development in the region and a total of 3558 candidates were trained through "Structured" and "Non-structured" courses. During the period, 121 extension programmes in the form of Farmers' Field days, Awareness / Enlightenment programmes, Technology demonstrations, Resham Krishi Mela, Workshops / Seminars etc. were conducted and more than 7422 farmers / seri-stakeholders got educated on various sericulture technologies.

I am happy to place on record that the Institute has become the front runner in implementation of Official Language (Hindi) and in this regard, for the year 2020-21 CSRTI, Berhampore has been awarded with third prize during the Regional Official Language Conference of Eastern and North Eastern States of India held on 08.12.2022 at Bhubaneswar, Odisha.

The undersigned, sincerely acknowledge with an immense amount of gratitude to all the learned Chairpersons and members of the Research Advisory Committee (RAC) and Research Coordination Committee (RCC) for their valuable guidance, the Member Secretary, CSB, Bengaluru for the administration support, Director (Tech) and RCS, CSB, Bengaluru for the technical support for achieving all the research endevours of CSRTI, Berhampore. Similarly due acknowledgements expressed to Sericulture departments of all states of E & NE India.

Lastly, I would like to congratulate team of scientists, technical, administrative staff of the Institute including nested units and all the external funding agencies (DBT, DST & NABARD) for their constant efforts and valuable contributions to achieve the set goals.

[Dr. Kishor Kumar, C. M.]
Director

के.रे.उ.अ.व.प्र.सं - बहरमपुर का संक्षिप्त विवरण

केन्द्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान (केरेउअवप्रसं) की स्थापना पूर्वी तथा उत्तर-पूर्वी भारत में (पूर्वः पश्चिम बंगाल, ओडिशा, बिहार, झारखंड, छत्तीसगढ़; उत्तर-पूर्व: अरुणाचलप्रदेश, असम, मणिपुर, मेघालय, मिजोरम, नागालैंड, सिक्किम एवं त्रिपुरा) रेशम उद्योग को अनुसंधान, विकासात्मक, तकनीकी, प्रौद्योगिकी, विस्तार सहायता प्रदान करने हेतु बहरमपुर में किया गया था। केरेउअवप्रसं, बहरमपुर का 80वाँ वर्ष जारी है तथा इस क्रम में, संस्थान द्वारा क्षेत्र हेतु उपयुक्त शहतूत उपजातियों का विकास, रेशमकीट नस्लों / संकरों, शहतूत कृषि के लिए पैकेज का अनुप्रयोग, रेशम कीटपालन व नवाचार/ उत्पादों/ प्रक्रियाओं के विकास में अपना महत्वपूर्ण योगदान किया गया है।

विजन

पूर्वी तथा उत्तर-पूर्वी राज्यों को रेशम कृषि के क्षेत्र में उत्कृष्ट केंद्र बनना

मिशन

- प्रमुख (थ्रस्ट) क्षेत्रों में अनुसंधान व विकास परियोजनाओं को आरंभ करना
- अधि-उपज शहतूत उपजातियों को लोकप्रिय बनाना
- क्षेत्र और मौसम विशिष्ट रेशमकीट संकरों को लोकप्रिय बनाना
- उन्नत शहतूत पैकेज को लोकप्रिय बनाना
- प्रौद्योगिकी हस्तांतरण कार्यक्रम का क्रियान्वयन
- लाभकारी रोजगार के अधिक से अधिक अवसर पैदा करना

उद्देश्य

- भारतीय रेशम के उत्पादन, उत्पादकता एवं गुणवत्ता को समृद्ध करने हेतु वैज्ञानिक, तकनीकी व आर्थिक अनुसंधान का संचालन करना
- परपोषी पौधों, रेशम कीटपालन, कोसोत्तर प्रौद्योगिकी तथा इसके प्रचार-प्रसार के लिए पैकेज का विकास
- उत्पाद एवं प्रौद्योगिकी व उद्योग इंटरफेस का व्यावसायीकरण
- इनपुट लागत व कठिन परिश्रम को कम करने का प्रयास
- शुद्ध आय एवं उत्पादकता बढ़ाने हेतु उप-उत्पाद का उपयोग
- आयात प्रतिस्थापन तथा विदेशी मुद्रा के अर्जन हेतु अंतरराष्ट्रीय स्तर के रेशम का उत्पादन बढ़ाना
- मानव संसाधन विकास
- प्रजनकों के स्टॉक का रख-रखाव
- रोग एवं पीड़क की निगरानी तथा पूर्वानुमान व पूर्व-चेतावनी
- आईसीटी उपकरणों के माध्यम से ज्ञान, अनुसंधान एवं विकास नवाचारों व शहतूत पैकेज का प्रचार-प्रसार
- प्रतिष्ठित राष्ट्रीय और अंतर्राष्ट्रीय अनुसंधान एवं विकास संस्थानों के साथ सहयोगात्मक अनुसंधान कार्यक्रम / परियोजनाओं का संचालन
- जारी अनुसंधान संबद्ध गतिविधियों एवं वैज्ञानिक व तकनीकी सेवाओं का समर्थन करने के लिए संस्थागत ढांचे को मजबूत करना
- बेहतर तालमेल के लिए अंतर-संस्थागत सहयोग
- रेशम कृषि प्रौद्योगिकियों की तकनीकी-आर्थिक व्यवहार्यता
- तकनीकी व परामर्श सेवाएं प्रदान करना

63 एकड़ के जीवंत परिसर में फल-फूल रहा यह संस्थान अनुसंधान एवं विकास के प्रमुख विषयों(शहतूत संवर्धन, रेशम संवर्धन, कोसोत्तर, विस्तार व क्षमता निर्माण)समेत सस्य विज्ञान व मृदा रसायन, प्रजनन व आनुवांशिकी (परपोषी पौध व कीट), फसल संरक्षण, कीटपालन प्रौद्योगिकी एवं जैव-प्रौद्योगिकी के साथ परियोजना मॉनिटरिंग समन्वय व मूल्यांकन

(पीएमसीई) कक्ष के अलावे प्रशासनिक इकाइयों से प्राप्त सक्रिय सहयोग से उत्कृष्टता की परिकल्पना कर रही है। संस्थान विभिन्न संस्थानों / संगठनों द्वारा प्रायोजित अनुसंधान एवं विकास परियोजनाएं भी संचालित करती है। साथ ही, केरेउअवप्रसं, बहरमपुर द्वारा हितधारकों के लाभार्थ प्रौद्योगिकी से जुड़े पैम्फलेट/पुस्तिकाओं का प्रकाशन विविध भाषाओं में नियमित रुप से किया जाता है। वैज्ञानिकगण राष्ट्रीय और अंतर्राष्ट्रीय पत्रिकाओं, वैज्ञानिक सेमिनार/ संगोष्ठियों में शोध-लेख प्रस्तुत करते हैं। हितधारकों में विकसित प्रौद्योगिकियों के प्रचार-प्रसार एवं उनसे नियमित तौर पर प्रतिक्रिया प्राप्त करने के लिए संस्थान के पास पूर्व एवं पूर्वोत्तर के क्रमशः पांच व आठ राज्यों में 3 क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्र (क्षेरेउअके) एवं 9 अनुसंधान विस्तार केंद्र (अविके) का विस्तार नेटवर्क है। ये अधीनस्थ इकाइयां संबंधित राज्यों में रेशम कृषि विभाग के साथ घनिष्ठ समन्वय स्थापित कर हितधारकों को तकनीकी सहायता प्रदान करती हैं। केरेउअवप्रसं, बहरमपुर संबंधित सरकार तथा गैर – सरकारी एजेंसियों के साथ समन्वय कर सभी विकासात्मक कार्यक्रमों का क्रियान्वयन करती है। कल्याणी विश्वविद्यालय, कल्याणी के तत्वावधान में, केरेउअवप्रसं, बहरमपुर में शहतूत रेशम कृषि में संपूर्ण भारत के छात्रों हेतु रेशम कृषि में 15 महीने का पोस्ट-ग्रेजुएट डिप्लोमा (PGDS) पाठ्यक्रम का संचालन किया जाता है। संस्थान में कृषकों, रीलरों, केरेबो व गैर-केरेबो अधिकारियों, छात्रों आदि के लिए विभिन्न विषयों में कई प्रशिक्षण कार्यक्रम आयोजित किए जाते हैं। केरेउअवप्रसं, बहरमपुर द्वारा स्नातकोत्तर [M.Sc.] के छात्रों हेतु भुगतान आधार पर शोध प्रबंध की सुविधा प्रदान करने का भी कार्य किया जाता है। प्रशिक्षण प्रभाग में आधुनिक कक्षाएं, पुस्तकालय व छात्रावास की सुविधाएं भी उपलब्ध हैं।

ABOUT CSRTI-BERHAMPORE

Central Sericultural Research & Training institute (CSRTI) was established at Berhampore for rendering research, training and extension support to the silk industry in Eastern and North Eastern India (East: West Bengal, Odisha, Bihar, Jharkhand, Chhattisgarh; North-East: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura). CSRTI-Berhampore is now in its 80th year and contributed a lot and still contributing to the development of mulberry varieties, silkworm breeds / hybrids, package of practices for mulberry cultivation, silkworm rearing and innovations / technologies/ products / processes suitable to the region.

VISION

- To become a Centre of Excellence in Sericulture in Eastern & North Eastern region

MISSION

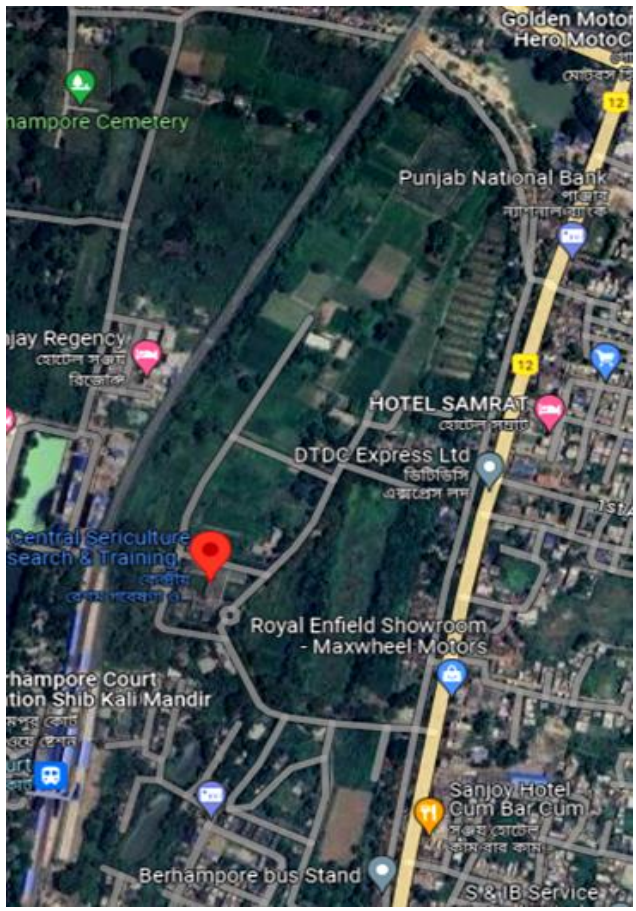
- Undertaking R&D projects in thrust areas
- Popularizing of high yielding mulberry varieties
- Popularizing region & season specific silkworm hybrids
- Popularization of improved package of practices
- Implementing Transfer of Technology programmes
- To create greater opportunities for gainful employment

OBJECTIVES

- 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

- By-product utilization to increase net income and productivity
- Enhance production of international grade silk for import substitution & earning foreign exchange
- Human Resource Development
- Maintenance of Breeders Stocks
- 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
- Techno-economic feasibility of sericulture technologies
- Providing technical and consultancy services

CSRTI, BHP established in 63-acre campus, envisages its excellence in major R&D disciplines like moriculture, sericulture, post-cocoon, extension & capacity building including Farm Management & Agronomy, Crop Protection, Rearing Technology and Biotechnology with active support from Project Monitoring Coordination & Evaluation (PMCE) cell. The institute undertakes R&D projects of its own as well as sponsored by various institutions/ organizations. It regularly publishes technology pamphlets/ booklets for the benefit of stakeholders in various languages. The scientists contribute research articles in national and international journals, scientific seminars / symposia.



For dissemination of developed technologies to the stakeholders and obtain regular feedback, the Institute has an extension network of 3 RSRSs and 9 RECs covering 5 Eastern and 8 North-Eastern states. These nested units provide technological support to the stakeholders in the respective states in close coordination with DoS. CSRTI-BHP also implements all the developmental programmes in co-ordination with government and non-government agencies.

Under the aegis of Kalyani University-Kalyani, CSRTI-BHP offers 15 months PGDS course for students across India in Mulberry Sericulture. The institute conducts several training programmes (upto 30 days) in various disciplines to the farmers, reelers, CSB & Non-CSB officials, students etc. CSRTI-BHP also facilitates M.Sc. students for Dissertation Works on payment basis. The training division has well-equipped classrooms, library and hostel facilities.

अनुसंधनात्मक एवं विकासात्मक उपलब्धियां

केन्द्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, बहरमपुर अपने तीन अधीनस्थ क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्रों [क्षेरेउअके] तथा नौ अनुसंधान विस्तार केन्द्रों [अविके] के साथ पूर्वी तथा उत्तर-पूर्वी राज्यों में रेशम उद्योग के विकास में उल्लेखनीय योगदान करते आ रहा है। शहतूत एवं रेशमकीट प्रजनन, फसल उत्पादन व संरक्षण, प्रौद्योगिकी के हस्तांतरण, विस्तार तथा प्रशिक्षण कार्य-कलापों में अनुसंधान व विकास गतिविधियों को आरंभ करने के परिणामस्वरुप पश्चिम बंगाल, ओडिशा, छत्तीसगढ़, झारखंड, बिहार, असम, नागालैंड, सिक्किम, मणिपुर, त्रिपुरा, मेघालय, अरुणाचल प्रदेश एवं मिजोरम राज्य के कृषकों के लिए उपयुक्त प्रौद्योगिकी विकसित की गई। मुख्य संस्थान एवं इसके अधीनस्थ केन्द्रों की वर्ष 2022-23 की प्रमुख उपलब्धियाँ निम्नानुसार हैः-

शहतूत फसल सुधार तथा संरक्षण

- नए शहतुत जीनोटाइप, सी-9 (सी-2058) ने चेक किस्म सी-2038 की तुलना में वर्षाश्रित लाल एवं लेटराइट मिट्टी (15.2 टन/हे.) तथा उत्तर पूर्वी क्षेत्र (26.6 टन/हे.) में 10% अधिक पत्ती उपज दर्ज की गई।
- चूर्णील आशिता की संवेदनशीलता में शामिल दो जीन MLO2 और MLO6A की पहचान की गई जिनका शहतूत में चूर्णील आशिता प्रतिरोध के विकास के लिए उपयोग किया जा सकता है।
- CBP-1 ने AICEM IV के तहत चेक C-2038 की तुलना में सिंचित एवं वर्षाश्रित परिस्थितियों के साथ-साथ चूर्णील आशिता के प्रतिरोध के साथ 10% अधिक औसत मौसमी पत्ती की उपज दर्ज की गई।
- चार नए शहतूत जीनोटाइप (PD-1, PD-8, PP-8 और PP-10) द्वारा पूर्वी तथा उत्तर-पूर्वी भारत की सिंचित और वर्षाश्रित दोनों स्थितियों में >10% अधिक पत्ती उत्पादकता दर्ज की गई।
- उत्तर एवं उत्तर-पूर्वी भारत के 4 राज्यों में 96 कृषकों (7.68 एकड़) के मध्य तीन नई शहतूत किस्मों (C-2038, C-2028 और C776) को लोकप्रिय बनाया गया।
- 120% आरडीएफ के साथ 2'×2' की दूरी के तहत सी-2038 की खेती के लिए अंतराल एवं पोषक तत्व खुराक पर अध्ययन द्वारा अनुशंसित खुराक/ नियंत्रण (59.52 टन/हेक्टेयर) की तुलना में 15% अधिक पत्ती उपज (68.50 टन/हेक्टेयर) एवं पोषक गुणवत्ता दर्ज की गई।
- नव विकसित बीएपी + एए आधारित सूत्रीकरण द्वारा पत्ती की उपज में 22.5% सुधार तथा विभिन्न नियंत्रणों पर वर्धक्यता 37.4% कम दर्ज किया गया तथा पत्ती की गुणवत्ता में सुधार (उच्च प्रोटीन) के साथ-साथ पत्ती की दीर्घायु (36.4%) एवं और पत्ती की उपज (19.2%) में आशाजनक सुधार (उच्च क्लोरोफिल और उच्च एंटीरेडिकल गतिविधि) दर्ज की गई।
- फाइनल उपज परीक्षणों के तहत, सात परीक्षण जीनोटाइप का मूल्यांकन किया गया एवं तीन जीनोटाइप C131 (45.72 टन/हेक्टेयर), E13 (44.72 टन/हेक्टेयर) व C174 (43.83 टन/हे) द्वारा C-2038 (की तुलना में (38.71 टन/हेक्टेयर) के साथ-साथ बेहतर पत्ती की गुणवत्ता एवं सिंचित स्थिति के तहत कम पीड़क गंभीरता के साथ 13% से अधिक उच्च पत्ती उपज दर्ज की गई। ।
- ड्रिप टेप एवं ड्रम-किट फर्टिगेशन द्वारा केरेउअवप्रसं, बहरमपुर तथा पूर्वी तथा उत्तर-पूर्वी राज्यों के वर्षाश्रित क्षेत्रों में नियंत्रण पर क्रमशः 28% एवं 33.5% अधिक पत्ती उपज दर्ज की गई।
- शहतूत पर्ण रोग नियंत्रण के लिए उपयुक्त फंगीटॉक्सिक के साथ-साथ रेशमकीट के लिए सुरक्षित रसायनों का पता लगाने के लिए मौजूदा फंगीसाइड बैविस्टिन के साथ नए उपलब्ध कम विषैले और प्रभावी कवकनाशी जैसे एज़ोक्सिस्टोरबिन, डाइफेनोकोनाज़ोल, फ्लक्सापायरोक्सैड, टेबुकोनाज़ोल, हेक्साकोनाज़ोल का मूल्यांकन। ज़हरीली खाद्य तकनीक के माध्यम से प्रयोगशाला मूल्यांकन के तहत पर्ण चित्ती (मायरोथेशियम रोरिडम) के विरुद्ध 96

घंटे के उपचार के बाद परीक्षण किए गए फफूंदनाशकों में से टेबुकोनाज़ोल, फ्लक्सापायरोक्सैड और हेक्साकोनाज़ोल बिना मायसेलियल ग्रोथ (0.00%) के साथ सबसे प्रभावी पाए गए।

- शहतूत कीट के प्रबंधन के लिए एक सामान्य जैविक नियंत्रण एजेंट क्राइसोपरला ज़स्त्रोवी सिलेमी की लोकप्रियता विभिन्न क्षेत्रों में थ्रिप्स की आबादी को मुर्शिदाबाद में 55.65%, मालदा में 53.31%, नदिया में 79.41%, सिक्किम में 70.48% असम में 70.97%, त्रिपुरा में 71.54% एवं ओडिशा में क्रमशः 64.91% तक कम करने में प्रभावी पाई गई।

रेशमकीट फसल सुधार व संरक्षण

- नया रेशमकीट संकर 12Y x BFC1, 40.28 किग्रा के नियंत्रण [N × (SK6 × SK7)] की तुलना में 45.3 किग्रा/100 रोमुच की कुल औसत कोसा उपज के साथ क्षेत्र में एक नई उत्पादक क्रॉस नस्ल बहुत ही आशाजनक पाई गई। संकर प्राधिकरण समिति, केंद्रीय रेशम वोर्ड, बेंगालुरु ने उत्तर तथा उत्तर- पूर्वी भारत में प्राधिकरण और वाणिज्यिक समुपयोजन के लिए 12Y × BFC1 की अनुशंसा की है।
- कवच अवयव (>19%) एवं उत्तरजीविता(>85%) के आधार पर, एनएफसी11(पी)xएनएफसी18(पी), एनएफसी19 (डी) x एनएफसीआर(डी) और एनएफसी18(एम) x नामक तीन द्विरपज नए फाउंडेशन संकर NFC12(M) की पहचान संभावित मेल घटकों के रूप में की गई।
- द्विप्रज डबल हाइब्रिड, बीएचपी-डीएच: (बीएचपी3 × बीएचपी2) × (बीएचपी8 × बीएचपी9) का ओएफटी के तहत पूर्वी तथा उत्तर पूर्वी भारत में 20000 रो मु च के साथ परीक्षण किया गया। एचएसी समिति द्वारा प्रगति की समीक्षा की गई और पूर्वी तथा उत्तर पूर्वी भारत में प्राधिकरण परीक्षणों के लिए द्विप्रज डबल हाइब्रिड की अनुशंसा की गई।
- बेंचमार्क मूल्यों की तुलना में बेहतर निस्तरी मार्क एवं प्लेन लाइनो को बेहतर वांछित लक्षणों के साथ देखा गया। अनुकूल मौसमों में उन्नत वंशक्रमों के वांछित लक्षणों के मान उर्वरता (467-477 संख्या), प्यूपेशन (97%), SCW (1.22-1.25g), SSW (0.17g), SR (13.60-13.93%) फिलामेंट की लंबाई (453-455 मी) थे। प्रतिकूल मौसमों में वांछित गुणों के मान उर्वरता (472-475 संख्या), प्यूपेशन (97%), SCW (1g), SSW (0.14-0.15g), SR (14-15%), रेशा लंबाई (429-430) थे। वांछित लक्षणों के मान चयनित एवं अचयनित जनसंख्या के बीच कम भिन्नता प्रदर्शित करते हैं जो लक्षणों के स्थिरीकरण का सुझाव देते हैं। उन्नत निस्तारी लाइनें BmNPV के लिए> 60% सहिष्णु हैं।
- पांच द्वीप्रज नस्लों (SK7HH, B.Con4HH, N5HH, WB1HH और HTH10HH) को उनकी उत्तरजीविता दर एवं डीएनए मार्करों की उपस्थिति के आधार पर उच्च तापमान व आर्द्रता सहिष्णुता के लिए चिन्हित किया गया। इन नस्लों का उपयोग पूरे वर्ष पूरे भारत में कीटपालन के लिए उपयुक्त दोहरे संकर विकसित करने के लिए मेटरनल पेरन्ट के रूप में किया जाता है।
- डीएनए मार्कर S0803 एवं S0816 (थर्मोटोलरेंट मार्कर) Pyx3 व Pyx4 (आर्द्रता सहिष्णु मार्कर) की पहचान थर्मो टॉलरेंट नस्लों के रूप में की गई।
- उच्च तापमान एवं आर्द्रता सहिष्णुता के लिए मार्कर सहायक चयन का उपयोग करके पूरे भारत में कीटपालन के लिए उपयुक्त नए द्विप्रज डबल हाइब्रिड विकसित करने हेतु एक नई परियोजना आरंभ की गई थी। दस लाइनों (HH2, HH2A, HH2B, HH27, HH27A, HH27B- अंडाकार घटक); (HH6, HH6A, HH26 और HH26A- डंबल घटक) को प्रजनन प्रक्रिया के लिए चुना गया। कोसा का चयन लार्वा के अंकन एवं कोसा के आकार के आधार पर किया गया था। उत्तरजीविता दर की गणना प्यूपेशन प्रतिशत के आधार पर की गई। वर्तमान में प्रजनन रेखाएँ F3 पीढ़ी में हैं।
- एंटीमाइक्रोबियल पेप्टाइड्स (PR1 और OLP) की पहचान शहतूत की पत्ती के प्रोटीन से की जाती है जो जीवाणु रोगजनक विकास को रोकता है। इसके अलावा दो नए रोगाणुरोधी पेप्टाइड्स sPR1 एवं SOLP को चिन्हित

एएमपी से डिज़ाइन किया गया है, जो बैसिलस एसपीपी, स्टैफिलोकोकस एसपीपी के खिलाफ जीवाणुरोधी गतिविधि प्रदर्शित करते हैं। माइक्रोकोकस एसपीपी जो बॉम्बिक्स मोरी में फ्लेचरी रोग का कारण बनता है।

- DST-JSPS परियोजना में, BmBDV प्रतिरोधी जीन nsd2 को फ्लेचरी के प्रति सहिष्णु म्यूटेंट विकसित करने के लक्ष्य के रूप में चयनित किया गया। जीनोम एडिटिंग प्रयोग करने के लिए बायोसे के आधार पर निस्तारी, 12वाई व एसके7 नस्लों का चयन किया जाता है।
- डीएसटी-जेएसपीएस परियोजना के तहत टोक्यो यूनिवर्सिटी ऑफ एग्रीकल्चर एंड टेक्नोलॉजी, जापान की अपनी यात्रा के दौरान भारतीय शोधकर्ताओं को जापानी सहयोगी द्वारा सीआरआईएसपीआर/ कैस निर्माण एवं बॉम्बिक्स मोरी अंडों में माइक्रोइंजेक्शन का उपयोग करके रेशम के कीड़ों में जीनोम संपादन प्रयोग करने के लिए प्रशिक्षित किया गया था।

दक्षता निर्माण व प्रशिक्षण

- उत्तर-पूर्वी भारत के आकांक्षी जिलों में रेशम-उद्यमिता के विकास के लिए एक डीबीटी वित्तपोषित परियोजना के तहत, बेसलाइन सर्वेक्षण किया गया और कुल 100 युवा महिला रेशम-किसानों [प्रत्येक चयनित जिले से 50: धलाई (त्रिपुरा) और चंदेल (मणिपुर)] लाभार्थियों के रूप में चयन किया गया है। रेशम उत्पादन की पारंपरिक खेती को व्यावसायिक रेशम उत्पादन मे वदलने के लिए, उच्च उपज देने वाली शहतूत किस्म (सी-2038), कीटाणुनाशक, चाकी कीटपालन, प्लास्टिक कोलैप्सिबल माउंटेज, शेल्फ-पालन रैक जैसे तकनीकी इनपुट और बेहतर रीलिंग इकाइयाँ की खरीद और वितरण के साथ प्रारंभिक सहायता प्रदान की गई है। ।
- हथकरघा, हस्तशिल्प और रेशम उत्पादन-त्रिपुरा विभाग और विभाग के सहयोग से 100 युवा महिला रेशम-किसानों के लिए चार उद्यमिता विकास कार्यक्रम (ईडीपी) आयोजित किए गए हैं ताकि उद्यमशीलता के गुणों को विकसित किया जा सके तथा रेशम उत्पादन में सुधार के संबंध में उनके ज्ञान को समृद्ध किया जा सके।
- पीजीडीएस, एफएसटी, टॉप, एसटीईपी, टीटीपी, ईडीपी, एसआरसी, एक्सपोजर विजिट एवं आवश्यकता आधारित प्रशिक्षण कार्यक्रमों आदि के माध्यम से 2000 के लक्ष्य के मुकाबले कुल 3575 उम्मीदवारों को प्रशिक्षित किया गया।
  - शहतूत रेशम उत्पादन में पीजीडीएस (2021-22: 16 छात्र एवं 2022-23: 24 छात्र)।
  - कृषक कौशल प्रशिक्षण (एफएसटी): 421 कृषकों को शहतूत की खेती, चाकी एवं उत्तरावस्था रेशमकीट पालन आदि के विभिन्न पहलुओं पर प्रशिक्षित किया गया। पूर्वी तथा उत्तर-पूर्वी किसानों के लाभार्थ संस्थान की अधीनस्थ इकाइयों अविके -दीमापुर (नागालैंड), अविके-मोथाबाड़ी (पश्चिम बंगाल), अविके-अगरतला (त्रिपुरा), क्षे रे उ अ के -जोरहाट (असम) एवं क्षे रे उ अ के -कोरापुट (ओडिशा) में भी एफएसटी कार्यक्रम आयोजित किए गए।
  - प्रौद्योगिकी उन्मुखीकरण कार्यक्रम (टीओपी): विभिन्न विषयों में वरिष्ठ तकनीकी सहायकों के लिए संकाय विकास प्रशिक्षण कार्यक्रम और योग्यता संवर्धन प्रशिक्षण के तहत 51 कर्मियों को प्रशिक्षित किया गया।
  - रेशम संसाधन केंद्र (एसआरसी): छह एसआरसी में 800 कृषकों को (20 किसान प्रति बैच/वर्ष की दर से 40 बैच) प्रशिक्षित किया गया।
  - प्रशिक्षकों का प्रशिक्षण कार्यक्रम: विभिन्न राज्यों के 10 (दस) वैज्ञानिकों ने इस संस्थान के संकाय सदस्यों/ विशेषज्ञों से रेशम उत्पादन गतिविधियों के विभिन्न पहलुओं में प्रशिक्षण प्राप्त किया। कार्यक्रम का आयोजन क्षेरेउअके-जोरहाट, असम में किया गया था।
  - STEP के तहत महिला किसानों के लिए प्रशिक्षण: प्रशिक्षण कार्यक्रम से 39 प्रशिक्षु लाभान्वित हुए।
  - एक्सपोजर विजिट: सीबीटी से 283 प्रशिक्षु और गैर-सीबीटी कार्यक्रमों से 758 प्रशिक्षुओं ने भाग लिया।
  - आवश्यकता आधारित प्रशिक्षण कार्यक्रम: 36 बैचों/कार्यक्रमों में 1189 कर्मियों को प्रशिक्षित किया गया। इस प्रशिक्षण के तहत 14 बैचों में उत्तर प्रदेश के रेशम उत्पादन किसानों के लिए शहतूत रेशम उत्पादन पर एक प्रारंभिक प्रशिक्षण आयोजित किया गया, जिसमें 599 किसान कार्यक्रम से लाभान्वित हुए।

कृषि प्रबंधन एवं रेशमकीट बीज प्रौद्योगिकी अनुभाग:

- पश्चिम बंगाल की वाणिज्यिक फसलों के दौरान बहुप्रज × द्विप्रज रोमुच के सतत उत्पादन के लिए पश्चिम बंगाल में बीज फसल उत्पादकता में सुधार हेतु और दक्षिण भारत से द्वीप्रज बीज कोसा की निर्भरता / परिवहन को दूर करने के लिए 200 बीज कृषकों को लाभार्थियों के रूप में चयनित किया गया।

रेशम उत्पादन विस्तार अर्थशास्त्र और प्रबंधन:

- मुर्शिदाबाद जिले के खड़ग्राम ब्लॉक में मल्लिकपुर और पोराडानागा में दो वाणिज्यिक चाकी पलुपालन केंद्र (सीआरसी) स्थापित किए गए।
- कुल 45100 रोमुच बहुप्रज × द्विप्रज रेशमकीट संकर [N × (SK6×SK7)] को 05 चॉकी फसलों में कीट पालित किया गया और इसे 50-150 रोमुच की रेंज में 454 किसानों को बेचा गया।
- लाभार्थी किसानों के लिए औसत कोसा उत्पादकता 49.11 किलोग्राम प्रति 100 रो मु च थी, जबकि नियंत्रित किसानों के लिए यह 42.98 किलोग्राम प्रति 100 रो मु च थी; अतः चॉकी कीट के उपयोग से प्रति 100 रोमुच कोसा उपज में 14.3% की वृद्धि दर्ज की गई।
- लाभार्थी किसानों के लिए कोसा की औसत दर रु. 401.40 प्रति किलोग्राम थी जबकि नियंत्रित किसानों के लिए यह रु 383.0 प्रति किलोग्राम थी।
- भारत परियोजना में शहतूत रेशम उत्पादन प्रौद्योगिकियों के प्रभाव आकलन के तहत, पश्चिम बंगाल के मुर्शिदाबाद, नदिया और बीरभूम जिलों के 8 गांवों से कुल 245 लाभार्थियों (पलुपालक और रीलर) का डेटा एकत्र किया गया था। फार्म सेक्टर प्रमोशन फंड (FSFP) श्रेणी के तहत 18.01.2023 को क्षेत्रीय कार्यालय-नाबार्ड, कोलकाता के "स्टेट क्रेडिट सेमिनार" के दौरान सम्मान के लिए चाकी पलुपालन केंद्र-मल्लिकपुर का चयन किया गया।
- मुर्शिदाबाद के 25 रेशम किसानों का मैसूर एवं कर्नाटक के अन्य रेशम कृषक क्षेत्रों में नाबार्ड-मुर्शिदाबाद के वित्त पोषण समर्थन के साथ रेशमचाष की नवीनतम तकनीकों के साथ वाणिज्यिक चाकी पलुपालन केंद्र अवधारणा के प्रबंधन के बारे में जागरूकता पैदा करने के लिए एक एक्सपोजर दौरा किया गया।

विस्तार संचार कार्यक्रम

#	कार्यक्रम	कार्यक्रमों की संख्या	प्रशिक्षित किए गए हितधारकों की सं.
		कुल	कुल
1	रेशम कृषि मेला-सह- प्रदर्शनी	04	1078
2	कृषक प्रक्षेत्र दिवस	21	1421
3	जागरुकता कार्यक्रम	47	3276
4	प्रौद्योगिकी प्रदर्शन /प्रबोधन कार्यक्रम	45	1022
5	कार्यशाला/सेमिनार और सम्मेलन	04	625
	कुल=	**121**	**7422**

प्रौद्योगिकी हस्तांतरण

अधि उपज देने वाली एवं जीवाणु पर्ण चित्ती प्रतिरोधी किस्मों सी-2070 का मूल्यांकन:

- उच्च उपज एवं बीएलएस प्रतिरोधी किस्म सी-2070 का विभिन्न मौसमों और स्थानों में मूल्यांकन किया गया। सी-2070 (45.5 टन/हेक्टेयर) की औसत पत्ती उपज सी-2038 (46.3 टन/हेक्टेयर) के बराबर थी और बीएलएस (2.4 पीडीआई) की तुलना में C2038 (8.1 PDI) और S1635 (13.1 PDI) से रोग आपतन की समस्याएं काफी कम थी।

उच्च उपज एवं कम तापमान तनाव सहिष्णु सी-2060 व सी-2065 का मूल्यांकन:

- परीक्षण जीनोटाइप के चार मौसमी मूल्यांकन से ज्ञात हुआ कि नए जीनोटाइप C2060 व C2065 में C2038 (6.90 t/ha) की तुलना में 3-13% अधिक पत्ती उत्पादकता दर्ज की गई। साथ ही टुकरा एवं माइरोथेशियम पर्ण चित्ती रोग की घटना भी कम हुई। सर्दियों के मौसम में, C2060 द्वारा C2038 (5.51 t/ha) की तुलना में 15% अधिक पत्ती उत्पादकता दर्ज करने के साथ ही साथ ही चूर्णील आशिता रोग का प्रकोप और गंभीरता में भी कमी दर्ज की गई।

पूर्व और पूर्वोत्तर भारत में शहतूत के लिए कम लागत वाली ड्रिप फर्टिगेशन:

- कम लागत वाली ड्रिप टेप और ड्रम किट फर्टिगेशन प्रणाली में सिंचित क्षेत्र में क्रमश: 28% (47.57 टन/ हेक्टेयर) और 15.86%(43.1 टन/ हेक्टेयर) नियंत्रण से अधिक पत्ती उपज (37.2 टन/हेक्टेयर) दर्ज की गई।
- वर्षाश्रित केंद्रों में, ड्रम किट फर्टिगेशन के तहत उच्च पत्ती उपज (20.79 से 46.23%) दर्ज की गई।

पर्यावरण अनुकूल रेशमकीट पालन संस्तर रोगाणुनाशक- सेरीविन का मूल्यांकन:

- पूर्वी तथा उत्तर क्षेत्रों (आरएसआरएस और आरईसी; पश्चिम बंगाल सरकार की डीओएस इकाइयां) में 23 परीक्षण स्थानों पर OST परीक्षणों के एक भाग के रूप में पर्यावरण और उपयोगकर्ता के अनुकूल संस्तर रोगाणुनाशक सेरी-विन की प्रभावकारिता का मूल्यांकन किया गया।
- उत्तर-पूर्वी राज्यों में दो फसलों (शरद ऋतु और वसंत) में, सेरी-विन उपचारित बैचों में औसत ईआरआर लैबेक्स (नियंत्रण उपचार) में 74.62% बनाम 77.05% था। पश्चिम बंगाल में, सेरी-विन उपचारित बैचों में औसत ईआरआर 75.64% दर्ज किया गया जबकि लैबेक्स (नियंत्रण उपचार) में यह 74.31% था।
- शहतूत की नई किस्मों का लोकप्रियकरण (सी-2038, टीआर-23/बीसी259 और सी-2028):
- तीन किस्मों C-2038 (35,000), Tr-23(2000), BC259 (5,000) के पौधे तैयार किए और किसानों को S-1635(20Q), C-2038(5Q), C776 (10 किग्रा) की कलमों की आपूर्ति की गई।
- C-2038 (30), BC259 (8) और C2028 (5) कृषकों के नवीन पौधारोपण की गई।

शहतूत कीटों के प्रबंधन हेतु जैव नियंत्रण एजेंटों को लोकप्रिय बनाना:

- परियोजना के तहत कुल 1.12 लाख क्राइसोपरला ज़स्त्रोवी सिलेमी अंडे (जैविक नियंत्रण एजेंट) का उत्पादन कर मुर्शिदाबाद में 68 किसानों के प्रक्षेत्र, नदिया में 24 किसानों के प्रक्षेत्र, मालदा में 23 किसानों के प्रक्षेत्र, कोरापुट, ओडिशा में 6 किसानों, ओडिशा में 10 किसानों के प्रक्षेत्र में इसका अनुप्रयोग किया गया। जोरहाट असम, अगरतला, त्रिपुरा में 10 किसानों के प्रक्षेत्र एवं सिक्किम में 10 किसानों के प्रक्षेत्र जो पूर्वी तथा उत्तर पूर्वी भारत के 5 अलग-अलग राज्यों में 7 स्थानों के साथ लगभग 50 एकड़ क्षेत्र को कवर करते हैं।
- विभिन्न क्षेत्रों में जैविक नियंत्रण एजेंट की शुरुआत के कारण औसत कीट (स्यूडोडेंड्रोथ्रिप्स मोरी) आबादी में कमी मुर्शिदाबाद (54.4%), मालदा(53.3%), नादिया (79.0%), सिक्किम (70.5%), असम (70.9%), ओडिशा में क्रमशः 61.55% और त्रिपुरा (71.5%) दर्ज की गई।

पर्यावरण अनुकूल कीटाणुनाशक-निर्मूल की लोकप्रियता:

- उत्तर-पूर्वी राज्यों (210 किसान) में 5% ब्लीचिंग पाउडर उपयोगकर्ताओं (नियंत्रण) के लिए पर्यावरण के अनुकूल गृह कीटाणुनाशक 'निर्मूल' का उपयोग करने वाले किसानों के साथ प्रति 100 रो मु च औसत कोसा उपज (द्विप्रज) 41.58 किलोग्राम दर्ज की गई।
- पश्चिम बंगाल में बहु x द्विप्रज संकर की पांच फसलों के दौरान निर्मूल को 980 किसानों के साथ लोकप्रिय किया गया। अनुकूल मौसमों (बैशाखी, अग्रहयानी और फाल्गुनी) के दौरान, निर्मूल उपयोगकर्ताओं के लिए प्रति 100 रो मु च औसत कोसा की उपज 44.88 किलोग्राम दर्ज की गई, जबकि 5% ब्लीचिंग पाउडर उपयोगकर्ताओं के लिए यह 41.87 किलोग्राम थी। प्रतिकूल फसलों (जैष्ठा, श्रावणी, भादुड़ी और अश्विना) के दौरान प्रति 100

रोमुच औसत कोसा उपज निर्मूल उपयोगकर्ताओं के लिए 34.48 किलोग्राम और 5% ब्लीचिंग पाउडर उपयोगकर्ताओं के लिए 32.78 किलोग्राम दर्ज की गई।

चाकी, प्ररोह/शेल्फ कीटपालन एवं प्लास्टिक कोलैप्सिबल माउंटेज को लोकप्रिय बनाना:

- कुल 7 चाकी कीटपालन केंद्र (1000 डीएफएलएस) 7 स्थानों पर स्थापित किए गए एवं लाभार्थियों को चाकी कीट वितरित किए गए।
- लाभार्थी किसानों के लिए औसत कोसा उत्पादकता 45.70 किलोग्राम प्रति 100 रो मु च दर्ज की गई। जबकि नियंत्रित किसानों के लिए यह 42.89 किलोग्राम प्रति 100 रो मु च थी; अतः चाकी कीटो के उपयोग से प्रति 100 रो मु च कोसा उपज में 6.56% की वृद्धि दर्ज की गई।
- 9 स्थानों पर 140 लाभार्थियों को प्ररोह कीट पालन एवं प्लास्टिक कोलैप्सिबल माउंटेज तकनीक अपनाने के लिए सहायता प्रदात की गई।
- लाभार्थी किसानों के लिए औसत कोसा उत्पादकता 43.47 कि.ग्रा./100 रो मु च थी जबकि नियंत्रित किसानों के लिए यह 40.86 कि.ग्रा./100 रो.मु.च. थी; अतः प्रति 100 रो.मु.च. कोसा उपज में 6.39% की वृद्धि दर्ज की गई।
- रेशमकीट के पारंपरिक ट्रे कीटपालन तुलना में शेल्फ-कीटपालन में श्रम आवश्यकता 42.86% कमी दर्ज की गई।

संपूर्णा की लोकप्रियता:

- फाइटोएक्डिसोन हार्मोन सम्पूर्णा वसंत और शरद ऋतु की फसलों के दौरान उत्तर-पूर्वी राज्यों में 340 किसानों के साथ और तीन मौसमों (अग्रहायनी, फाल्गुनी, और बैसाखी) के दौरान पश्चिम बंगाल में 750 किसानों के बीच लोकप्रिय बनाया गया। के उपयोग के परिणामस्वरूप सतत लार्वा परिपक्वता एवं कताई की आरंभ हुई। पाँचवी इंस्टार लार्वा का उपचार संपूर्णा द्वारा 7वें और 8वें दिन पूर्ण होने के पश्चात यह कटाई के लिए भी 24 घंटे के अंतर्गत कीट को तैयार कर देती है। उक्त के प्रयोग से माउंटेज अवधि को 48 घंटे से घटाकर 24-30 घंटे हो गए जिसके परिणामस्वरूप सफल कोसा की प्राप्ति एवं फसल के नुकसान को भी रोका गया।

पेटेंट एवं व्यावसायीकरण:

- नव विकसित पर्यावरण के अनुकूल गृह कीटाणुनाशक "निर्मूल" हेतु लिए व्यापार चिह्न (वर्ड मार्क) को ट्रेड मार्क रजिस्ट्री, भारत सरकार द्वारा स्वीकृत करते हुए इसे क्लास 5 के तहत सफलतापूर्वक पंजीकृत किया गया। उक्त को दिनांक 10/10/2022 को ट्रेड मार्क जर्नल नंबर: 2073 (पृष्ठ संख्या-500), ट्रेड मार्क रजिस्ट्री के कार्यालय, भारत सरकार, बौद्धिक संपदा भवन (आई.पी. भवन), मुंबई द्वारा में प्रकाशित किया गया।
- नव विकसित ईको-फ्रेंडली गृह कीटाणुनाशक "निर्मूल" के पेटेंट आवेदन को दिनांक 15/04/2022 को पेटेंट कार्यालय के आधिकारिक जर्नल, जर्नल नंबर 15/2022 (पेज नंबर-31699) में प्रकाशित किया गया। उक्त की जांच प्रतीक्षित है।
- इको-एंड-यूज़र फ्रेंडली, ब्रॉड-स्पेक्ट्रम रेशमकीट पालन संस्तर कीटाणुनाशक 'सेरी-विन' हेतु पेटेंट आवेदनार्थ व आगे के निर्देश के लिए केंद्रीय कार्यालय, बैंगलोर को प्रस्तुत किया गया है।

सहयोगी परियोजनाएं

- नाबार्ड द्वारा वित्त पोषित परियोजना (MOE 02011EF)।
- SBRL-बैंगलोर परियोजना (PRP 08002 MI और AIT08005MI)।
- उत्तर बंगाल विश्वविद्यालय, सिलीगुड़ी, पश्चिम बंगाल (AIC02004CN)।
- DST-JSPS जापान (AIT02012CI) के साथ।
- सीएसटीआरआई-बेंगलुरु (एआईबी 02009एमआई) के साथ।
- CSGRC होसुर कर्नाटक (AIE06002MI) के साथ।
- सीएसआरटीआई-मैसूर (AIB01009MI) के साथ।
- जैव प्रौद्योगिकी विभाग, नई दिल्ली (MOT02016EF) के साथ।
- केवीके, कलिम्पोंग, प.बं. (MTL02017CN) के साथ।

पूर्वी तथा उत्तर-पूर्वी भारत में क्लस्टर संवर्धन कार्यक्रम (सीपीपी)

- आठ मेगा क्लस्टर (पश्चिम बंगाल में मालदा और मुर्शिदाबाद; मणिपुर-समतल स्थल एवं मणिपुर-पहाड़ी; असम-निचली और असम-ऊपरी; मिजोरम में आइजोल; पश्चिम त्रिपुरा) में 1398.31 टन कोसा का उत्पादन दर्ज किया गया। कच्चे रेशम का उत्पादन (बीवी: 75.59 टन और आईसीबी: 86.67 टन) का उत्पादन दर्ज किया गया ।

स्वच्छता पखवाड़ा

- दिनांक 01.03.2023 से 15.03.2023 के दौरान 'स्वच्छता पखवाड़ा' कार्यक्रम के तहत कई गतिविधियों जैसे पखवाड़े के दौरान स्वच्छता अभियान, पोस्टर प्रतियोगिता, पुरानी फाइलों की छंटाई, पर्यावरण जागरूकता अभियान, 'व्यक्तिगत स्वच्छता' पर वार्ता, 'रोड शो', 'स्वच्छता और स्वच्छता' पर एक संगोष्ठी का भी आयोजन किया गया। संस्थान के सभी कर्मचारियों ने कार्यालय परिसर को साफ रखने की शपथ ली। मुर्शिदाबाद जिले के सागर ग्राम में जागरूकता कार्यक्रम आयोजित किया गया। जनता के बीच जागरूकता पैदा करने के लिए एक 'रोड शो' दिनांक 13.03.23 को आयोजित किया गया था और जिसका कवरेज आनंद बाजार पत्रिका, वर्तमान, आज तक, ऑल इंडिया रेडियो, टीवी9 आदि जैसे प्रेस द्वारा व्यापक रूप से किया गया था।

मल्टीमीडिया गतिविधियाँ:

इकाइयां	विषय	भाषा और चैनल
रेडियो कार्यक्रम /Radio programme		
केरेउअवप्रसं-बीएचपी	डॉ. एस. चक्रवर्ती, वैज्ञानिक-डी (16.02.23) द्वारा रेशम उत्पादन प्रौद्योगिकियों में सुधार	बंगाली (एआईआर-एमएसडी)
फेसबुक कार्यक्रम		
केरेउअवप्रसं--बीएचपी	रेशम कृषि मेला का प्रसारण 15 सोशल मीडिया के वेबसाइट पर बंगला में किया गया	बंगाली
क्षे रे उ अ के - कालिम्पोंग /	रेशम कृषि मेला	नेपाली
क्षे रे उ अ के - जोरहाट	रेशम कृषि मेला का प्रसारण स्थानीय समाचार असमिया में किया गया	असमी
ट्विटर @CsrtiBerhampore/Twitter @ CsrtiBerhampore		
इंस्टाग्राम @CSRTIBERHAMPORE /Instagram @ CSRTIBERHAMPORE		
फेसबुक @ ईस्ट नॉर्थ ईस्ट सिल्क /Facebook @ East North East Silk		
व्हाट्सएप @ केरेउअवप्रसं-बहरमपुर तथा और केरेउअवप्रसं-बहरमपुर की उप-इकाइयां/ WhatsApp @ CSRTI-Berhampore and Sub-units of CSRTI-Berhampore		

प्रकाशन:

शोध पत्र - (अंतर्राष्ट्रीय -15 एवं राष्ट्रीय -8);

लोकप्रिय लेख -1;

पुस्तिका / पुस्तक अध्याय/ पुस्तिका -7;

सम्मेलनों/ सेमिनारों/ संगोष्ठियों आदि में प्रस्तुत पत्र- (अंतर्राष्ट्रीय -12 एवं राष्ट्रीय -28);

वैज्ञानिकों द्वारा ऑनलाइन अनुसंधान/प्रशिक्षण कार्यक्रम में भाग लिया- 15;

पैम्फलेट/ बुकलेट – 4; पोस्टर -4

R & D ACHIEVEMENTS AND MAJOR EVENTS

Central Sericultural Research & Training Institute, Berhampore along with three Regional Sericultural Research Stations (RSRSs) and nine Research Extension Centres (RECs) are rendering significant services for the development of sericulture industry in Eastern & North Eastern states. R & D activities undertaken in host plant and silkworm improvement through breeding, crop production & protection, transfer of technology, Sericulture Extension Economics and Management and CBT activities have resulted in developing improved technologies suitable for the farmers in the 13 states *viz.* West Bengal, Odisha, Chhattisgarh, Jharkhand, Bihar, Assam, Nagaland, Sikkim, Manipur, Tripura, Meghalaya, Arunachal Pradesh and Mizoram. The salient achievements of the institute and its nested units for the year 2022-23 are as follows:

MULBERRY CROP IMPROVEMENT, PRODUCTION & PROTECTION

- New genotype, C-9 (C-2058) performed >10% higher leaf yield under rainfed red & laterite soils (15.15 t/ha) and North Eastern region (26.55 t/ha) over check variety C-2038.
- Identified two candidate genes MLO2 and MLO6A involved in powdery mildew susceptibility which may be exploited for development of powdery mildew resistance in mulberry.
- CBP-1 recorded >10% higher mean seasonal leaf yield under irrigated and rainfed conditions along with resistance to powdery mildew compared to check C-2038 under AICEM IV.
- Four new mulberry genotypes (PD-1, PD-8, PP-8 & PP-10) recorded >10% higher leaf productivity under both irrigated and rainfed conditions of E & NE India.
- Three new mulberry varieties (C-2038, C-2028 and C776) were popularized among 96 farmers (7.68 acres) in 4 states of E & NE India.
- Study on spacing and nutrient dose for C-2038 cultivation under 2'×2' spacing with 120% RDF recorded 15% higher leaf yield (68.50 t/ ha) and nutritive quality compared to recommended dose/ control (59.52 t/ha).
- Newly developed BAP + AA based formulations improved the leaf yield by 22.5% and decreased senescence by 37.4% over different controls and showed promising improvement in leaf longevity (36.4%) & leaf yield (19.2%) along with improved leaf quality (higher protein, higher chlorophyll & higher antiradical activity).
- Under Final yield trials, seven test genotypes were evaluated and three genotypes C131 (45.72 t/ha), E13 (44.72 t/ha) & C174 (43.83 t/ha) recorded more than 13% higher leaf yield over C-2038 (38.71 t/ha) along with better leaf quality & lower pest severity under irrigated condition.
- Drip tape & drum-kit fertigation recorded 28% & 33.5% higher leaf yield over control at CSRTI, Berhampore and rainfed areas of E & NE states respectively.
- Evaluation of newly available less toxic and effective fungicides namely Azoxystorbin, Difenoconazole, Fluxapyroxad, Tebuconazole, Hexaconazole along with existing fungicide Bavistin to find out suitable fungitoxic as well as safe to silkworm chemicals for mulberry foliar diseases control. Among the tested fungicides Tebuconazole, Fluxapyroxad and Hexaconazole were found to be most effective with no mycelial growth (0.00%) after 96 hours of treatment against leaf spot (*Myrothecium roridum*) under laboratory evaluation through poisoned food technique.

- Popularization of Biological Control Agent *Chrysoperla zastrowi sillemi* a generalist predator for management of mulberry pest was found to be effective in reduction of thrips population in different areas by 55.65% in Murshidabad, 53.31% in Malda, 79.41% in Nadia, 70.48% in Sikkim, 70.97% in Assam, 71.54% in Tripura and 64.91% in Odisha, respectively.

SILKWORM CROP IMPROVEMENT, PRODUCTION & PROTECTION

- 12Y x BFC1, a new productive cross breed found very promising in the region with an overall average cocoon yield of 45.3 kg/ 100 dfls against control [N × (SK6 × SK7)] of 40.28 kg. Hybrid authorization committee, CSB, Bengaluru has authorized 12Y × BFC1 for commercial exploitation in E and NE India.
- Based on the shell content (>19%) and survival (>85%), three bivoltine new foundation crosses namely NFC11(P) x NFC18(P), NFC19(D) x NFCR(D) and NFC18(M) x NFC12(M) were identified as potential male components.
- Bivoltine double hybrid, BHP-DH: (BHP3 × BHP2) × (BHP8 × BHP9) tested with 20000 dfls in E and NE India under OFT. The progress of was reviewed by the HAC committee and recommended the bivoltine double hybrid for authorization trials in E and NE India.
- Improved Nistari Marked and Plain lines were observed with improved desired traits in comparison with the bench mark values. In favourable seasons the values of the desired traits of the improved lines were fecundity (467-477 Nos), pupation (97%), SCW (1.22-1.25g), SSW (0.17g), SR (13.60-13.93%), filament length (453-455m). In unfavourable seasons the values of the desired traits were fecundity (472-475 Nos), pupation (97%), SCW (1g), SSW (0.14-0.15g), SR (14-15%), filament length (429-430m). The values of the desired traits exhibit less variation between selected and unselected population suggesting stabilization of the traits. The improved Nistari lines are > 60% tolerant to BmNPV.
- Five Bivoltine Breeds (SK7HH, B.Con4HH, N5HH, WB1HH and HTH10HH) have been identified for high temperature and humidity tolerance based on their survival rate and presence of the DNA markers. These breeds are utilized as maternal parent for developing double hybrids suitable for rearing across India throughout the year.
- DNA markers S0803 & S0816 (thermotolerant markers) *Pyx3 & Pyx4* (Humidity tolerant markers) were assessed in the identified thermo tolerant breeds.
- A project was initiated to develop bivoltine double hybrid suitable for rearing across India using marker assisted selection for high temperature and humidity tolerance. Ten lines (HH2, HH2A, HH2B, HH27, HH27A, HH27B- Oval component); (HH6, HH6A, HH26 and HH26A- dumbbell component) have been shortlisted for breeding process.
- Antimicrobial peptides (PR1 and OLP) are identified from the mulberry leaf protein that inhibited bacterial pathogen growth. Further two novel antimicrobial peptides sPR1 and sOLP are designed from the identified AMPs which exhibited antibacterial activity against *Bacillus spp., Staphylococcus spp. and Micrococcus spp.* that cause flacherie disease in *Bombyx mori*.
- In the DST-JSPS project, BmBDV resistant gene *nsd2* is selected as target to develop mutants tolerant to flacherie. Nistari, 12Y and SK7 breeds are selected based on bioassay to conduct genome editing.
- Indian investigators on their visit to Tokyo University of Agriculture and Technology, Japan under DST-JSPS project were trained by Japanese Collaborator on conducting genome editing experiments in silkworms using CRISPR/ Cas construct and microinjection of the construct in *Bombyx mori* eggs.

CAPACITY BUILDING & TRAINING PROGRAMMES

- A DBT funded project for development of Seri-Entrepreneurship in Aspirational Districts of North-Eastern India, baseline survey conducted and a total of 100 young women seri-farmers [50 from each selected district: Dhalai (Tripura) and Chandel (Manipur)] have been selected as beneficiaries. In order to uplift traditional sericulture farming into commercial one, an initial handholding support has been provided with procurement and distribution of technological inputs like high-yielding mulberry variety (C-2038), disinfectants, chawki rearing kit, plastic collapsible mountages, shelf-rearing racks and improved reeling units.
- Four Entrepreneurship Development Programmes (EDPs) have been organized to 100 young women seri-farmers for inculcating the entrepreneurial traits and to enhance the knowledge on improved sericulture farming practices in collaboration with the Department of Handloom, Handicrafts, and Sericulture-Tripura and the Department of Sericulture-Manipur.
- A total of 3575 candidates were trained against the target of 2000 through PGDS, FST, TOP, STEP, TTP, EDP, SRC, exposure visits, & need based training programmes etc.
  - **PGDS in Mulberry Sericulture** (2021-22: 16 students and 2022-23: 24 students).
  - **Farmers Skill Training (FST):** 421 farmers were trained on various aspects of mulberry cultivation, chawki and late age silkworm rearing *etc.* FST programmes were organized in nested units e.g. REC-Dimapur (Nagaland), REC-Mothabari (W.B), REC-Agartala (Tripura), RSRS-Jorhat (Assam) and RSRS-Koraput (odhisa) for the benefit of eastern and north-eastern farmers.
  - **Technology Orientation Programme (TOP):** 51 personnel were trained under Faculty Development Training Programme and Competency Enhancement Training for STAs in various disciplines.
  - **Seri Resource Centre (SRC):** 800 farmers (40 batches @ 20 per batch/year) were covered at the six SRCs.
  - **Trainers' Training Programme:** 10 (ten) Scientists from KVKs of various states undergone the training in different aspects of sericultural activities from the faculty members /experts of this Institute. The Programme was organized at RSRS-Jorhat, Assam.
  - **Training for the women farmers under STEP:** 39 trainees benefitted from the training programme.
  - **Exposure Visits:** 283 trainees from CBT and 758 trainees from Non-CBT programmes had undertaken.
  - **Need Based Training Programmes:** 1189 personnel were trained in 36 batches/ programmes. Under this training, introductory mulberry sericulture were taught for Uttar Pradesh sericulture farmers in 14 batches where 599 farmers got benefitted from the programme.

FARM MANAGEMENT AND SILKWORM SEED TECHNOLOGY SECTION:

- A total of 200 seed farmers have been selected as beneficiaries for improvement of seed crop productivity in West Bengal for sustainable production of M x Bi dfls in West Bengal and to overcome the dependency/ transportation of bivoltine seed cocoons from south India.

SERICULTURE EXTENSION ECONOMICS AND MANAGEMENT:

- Two commercial chawki rearing centres (CRCs) at CRC-Mallikpur and CRC-Poradanga at Khargram block, Murshidabad district established.

- A total of 45,100 dfls of Multi×Bi silkworm hybrids [N × (SK6 × SK7)] were reared in 05 chawki crops and the same was sold to 454 farmers in the range of 50-150 dfls.
- The average cocoon productivity was 49.11 kg per 100 dfls for the beneficiary farmers while it was 42.98 kg per 100 dfls for control farmers; hence there is gain of 14.3% in cocoon yield per 100 dfls by use of chawki worms.
- The average rate of cocoon was ₹401.40 per kg for beneficiary farmers while it was ₹383.0 per kg for control farmers.

❖ Under Impact Assessment of Mulberry Sericulture Technologies in India project, a total of 245 beneficiaries' (rearers and reelers) data was collected from 8 villages of Murshidabad, Nadia and Birbhum districts of West Bengal.

❖ CRC-Mallikpur has been selected for felicitation during the "State Credit Seminar" of RO-NABARD, Kolkata on 18.01.2023 under Farm Sector Promotion Fund (FSFP) category.

❖ An exposure visit of 25 sericulture farmers of Murshidabad to Mysore and other sericulture areas of Karnataka for creating awareness regarding commercial CRC concept its management with latest technologies of sericulture with funding support of NABARD-Murshidabad.

EXTENSION COMMUNICATION PROGRAMMES

#	Programmes	No. of events	Stakeholders sensitized (No.)
1	Krishi Mela/ Reelers mela cum exhibition	04	1078
2	Farmers Field day	21	1421
3	AW programme	47	3276
4	Technology demonstration / Enlightenment programmes	45	1022
5	Workshop/ Seminars & Conferences	04	625
	Total=	**121**	**7422**

TRANSFER OF TECHNOLOGY

❖ **Evaluation of high yielding & bacterial leaf spot resistant varieties C-2070:**

- High yielding & BLS resistant variety C2070 was evaluated in different seasons & locations and shown mean leaf yield of C2070 (45.5 t/ha) was on par with C2038 (46.3 t/ha) and significantly less incidence of BLS (2.4 PDI) compared to C2038 (8.1 PDI) & S1635 (13.1 PDI).

❖ **Evaluation of High yielding and Low temperature stress tolerant C-2060 and C-2065:**

- Four seasonal evaluation of test genotypes revealed, new genotypes C2060 & C2065 recorded 3-13% higher leaf productivity over C2038 (6.90 t/ha) along with lower incidence of tukra and myrothecium leaf spot disease.
- In winter seasons, C2060 recorded 15% higher leaf productivity over C2038 (5.51 t/ha) along with infestation and severity of powdery mildew disease.

❖ **Low-cost drip fertigation for mulberry in E & NE India:**

- Low-cost drip tape & drum kit fertigation system recorded 28 % (47.57 t/ha) & 15.86% (43.05 t/ha) higher leaf yield over control (37.16 t/ha) respectively, in irrigated area.
- In rainfed centres, higher leaf yield (20.79 to 46.23%) was observed under drum kit fertigation.

- **Evaluation of eco-friendly silkworm rearing bed Disinfectant- Seriwin:**
  - The efficacy of eco-and-user friendly bed disinfectant Seri-Win was evaluated as a part of OST trials at 23 test locations in the E & NE regions (RSRSs and RECs; DOS units of Govt. of WBl).
  - Across two crops (autumn and spring) in North-eastern states, the average ERR in Seri-Win treated batches was 77.05% versus 74.62% in Labex (control treatment). In West Bengal, the average ERR was recorded as 75.64% in Seri-Win treated batches versus 74.31% in Labex (control treatment).
- **Popularization of new mulberry varieties (C-2038, Tr-23/$BC_2$59 & C-2028):**
  - Generated saplings of three varieties C-2038 (35,000), Tr-23 (2000), BC259 (5,000) and supplied cuttings of S-1635 (20Q), C-2038 (5Q), C776 (10 kg) to farmers.
- **Popularization of Bio-control agents for the management of mulberry pests:**
  - Total 1.12 lakhs of *Chrysoperla zastrowi sillemi* eggs (Biological control agent) were produced under the project and released with 68 farmers field in Murshidabad, 24 farmers field in Nadia, 23 farmers field in Malda, 6 farmers in Koraput, Odisha, 10 farmers in Jorhat Assam, 10 farmers in Agartala, Tripura and 10 farmers in Sikkim which covers approximately 50 acres of area with 7 locations in 5 different states of Eastern and North Eastern India.
  - Average pest (*Pseudodendrothrips mori*) population reduction noticed by way of introduction of biological control agent in different areas were 54.36% in Murshidabad, 53.31% in Malda, 79% in Nadia, 70.48% in Sikkim, 70.97% in Assam, 71.54% in Tripura and 61.55% in Odisha, respectively.
- **Popularization of eco-friendly disinfectant –NIRMOOL:**
  - The average cocoon yield (bivoltine) per 100 dfls was recorded as 41.58 kg with the farmers who have used the eco-friendly room disinfectant 'Nirmool' and 38.27 kg for 5% bleaching powder users (control) in NE states (210 farmers).
  - In West Bengal, Nirmool was popularized with 980 farmers during five crops of multi x bivoltine cross. During favourable seasons (Baishakhi, Agrahayani and Falguni), average cocoon yield per 100 dfls was recorded as 44.88 kg for Nirmool users versus 41.87 kg for 5% bleaching powder users. During unfavourable crops (Jaistha, Shravani, Bhaduri and Ashwina) average cocoon yield per 100 dfls was 34.48 kg for Nirmool users and 32.78 kg for 5% bleaching powder users.
- **Popularization of Chawki, Shoot/ Shelf rearing & plastic collapsible mountages:**
  - A total of 7 Chawki Rearing Centres (1000 dfls) were established at 7 locations and chawki worms were distributed to the beneficiaries.
  - The average cocoon productivity observed 45.70 kg per 100 dfls for the beneficiary farmers while it was 42.89 kg per 100 dfls for control farmers; and hence there was a gain of 6.56% in cocoon yield per 100 dfls by use of chawki worms.
  - Assistance was given to 140 beneficiaries at 9 locations to adopt shoot rearing & plastic collapsible mountages technology.
  - The average cocoon productivity was 43.47 kg per 100 dfls for the beneficiary farmers while it was 40.86 kg per 100 dfls for control farmers; and hence there was a gain of 6.39% in cocoon yield per 100 dfls.
  - Besides, there was a reduction of 42.86% in labour requirement in case of shelf-rearing as compared to traditional tray rearing method of silkworm.

❖ **Popularization of Sampoorna:**

- The phytoecdysone hormone Sampoorna was popularised with 340 farmers in the North-eastern states during the spring and autumn crops, and with 750 farmers in West Bengal during three seasons (Agrahayani, Falguni, and Baisakhi). The use of Sampoorna resulted in consistent larval maturity and commencement of spinning. Sampoorna treatment to V^{th} instar larvae on 7^{th} & 8^{th} day induced spinning within 24 h of treatment. It reduced mountage period from 48 h to 24-30 h, resulted in successful cocoon formation and prevented crop loss.

PATENT & COMMERCIALIZATION:

- The trade mark (word mark) for the newly developed eco-friendly room disinfectant "NIRMOOL" was accepted by the Trade Marks Registry, Government of India and successfully registered under Class 5. The same was published in Trade Marks Journal No: 2073 (Page No-500), dated 10/10/2022 by Office of The Trade Marks Registry, Government of India, Baudhik Sampada Bhavan (I.P. Bhavan), Mumbai.
- The patent application for the newly developed eco-friendly room disinfectant "NIRMOOL" was published in the Official Journal of the Patent Office, Journal No. 15/2022 (Page No-31699) dated 15/04/2022 and examination of the same is awaited.
- A patent application for eco-and-user friendly, broad-spectrum silkworm rearing bed disinfectant 'Seri-Win' was submitted to Central Office, Bangalore for further instruction.

COLLABORATION

- With NABARD funded project **(MOE 02011EF).**
- With SBRL-Bangalore project (**PRP 08002 MI & AIT08005MI).**
- With North Bengal University, Siliguri, West Bengal (**AIC02004CN)**
- With DST-JSPS Japan **(AIT02012CI).**
- With CSTRI-Bengaluru (**AIB 02009MI).**
- With CSGRC Hosur **-**Karnataka **(AIE06002MI).**
- With CSRTI-Mysuru **(AIB01009MI).**
- With Department of Biotechnology, New Delhi **(MOT02016EF).**
- With KVK, Kalimpong, WB **(MTL02017CN).**

CLUSTER PROMOTION PROGRAMME (CPP) IN E & NE INDIA

- Eight Mega clusters (**Malda and Murshidabad** in West Bengal**; Manipur-Plain** and **Manipur-Hill**; **Assam-Lower and Assam-Upper**; **Aizawl** in Mizoram; **West Tripura**) have produced **1398.306** tons of cocoons and recorded **162.31** tons (78.4%) of raw silk production (BV: **75.63** tons & ICB: **86.68** tons).

SWACHHATA PAKHWADA

- Under the '**Swacchata Pakhwada'** programme during 01.03.2023 to 15.03.2023, several activities viz. cleanliness drive, poster competition, weeding out of old files, environmental awareness campaign, a talk on "**Personal Hygiene**", **'Road show'**, a seminar on "**Hygiene and Sanitaigation**" were undertaken during the fortnight. All the employees of this institute took pledge to observe cleanliness in office premise. Awareness Programme has been conducted at Sagar Para village, Murshidabad district. A 'Road Show' for creating awareness among the public was conducted on 13.03.23 which was widely covered by media and press like Ananda Bazar patrika, Bartaman, Aaj Tak, All India Radio, TV9 etc.

Multimedia Activities:

Units	Topics	Language & Channel
Radio programme		
CSRTI-BHP	Improved of Sericultural technologies by Dr. S. Chakraborty, Sc-D (16.02.23)	Bengali (AIR-MSD)
Facebook programme		
CSRTI-BHP	Resham Krishi Mela telecasted through 15 social media sites	Bengali
RSRS-Kalimpong	Resham Krishi Mela	Nepali
RSRS-Jorhat	Resham Krishi Mela telecasted on local news	Assamese
Twitter @ CsrtiBerhampore		
Instagram @ CSRTIBERHAMPORE		
Facebook @ East North East Silk		
WhatsApp @ CSRTI-Berhampore and Sub-units of CSRTI-Berhampore		

PUBLICATIONS:

- Research papers- (International –15 & National - 8)
- Popular Article -1 ;
- Book Chapters- 7;
- Papers Presented in Conferences/Seminars/Symposia,etc.- (International– 12 & National -28) ;
- Scientists attended Online Research / Training Programme- 15;
- Pamphlets / Booklets –4/ Poster-4

MULBERRY BREEDING & GENETICS

Concluded Research Project

PRP 08002MI: Identification of powdery mildew resistant genes and validation of CAPS marker for Chalcone synthase in mulberry Spp. caused by Phyllactinia corylea (Pers.) Karst.
(Collobarative project of SBRL-Bangalore)
[May, 2019 to May, 2022]

Suresh, K. (PI-CSRTI-Berhampore), Ramesha, A. (PI- SBRL-Bangalore), Dubey, H. and Vijayan, K.

Objectives:

- To identify powdery mildew susceptibility genes Mildew Resistance Locus O (MLO) from mulberry.
- To screen powdery mildew resistant mulberry genotypes for an association of non-functional mutation in the candidate MLO gene with disease resistance.
- Validation of CAPS marker for chalcone synthase gene involved in powdery mildew resistance in diverse germplasm accessions/segregating progenies.

Powdery mildew disease resistant pseudo F_2 populations of V-1 × Kajli OP and S-1 × Vietnam-2 along with their parents were established in Augmented Randomised Block Design (ARBD) under paired row cultivation. The selected mulberry accessions were also planted in ARBD design. The progenies and accessions were planted in a single row of 5 m^2 area separated by a spreader row at one side. Two plantation was pruned as per commercial crop schedules of west Bengal and recommended package of practices of mulberry cultivation under irrigated condition was followed.

Phenotyped two pseudo F_2 populations and germaplsm accessions for powdery mildew disease under natural epiphytotic condition during 2019 to 2022. The germplasm was screened for both naturally in field and artificialy in glasshouse conditions by spraying collected spores. Desiease severity data was collected from five randomly selected plants and scored on 3 fixed branches of each plant. The percentage of leaf area affected by mildew was assessed visually on a 0 (resistant) to 5 (susceptible) scales. Percent disease index (PDI) was calculated for each genotype according to Kim *et al*. (2000). The ratio of resistant and susceptible progenis were compared to expected Mendelian segregation ratio by the chi-square test (p = 0.05).

Powdery mildew severity (PDI) in Pseudo F_2 populations of mulberry

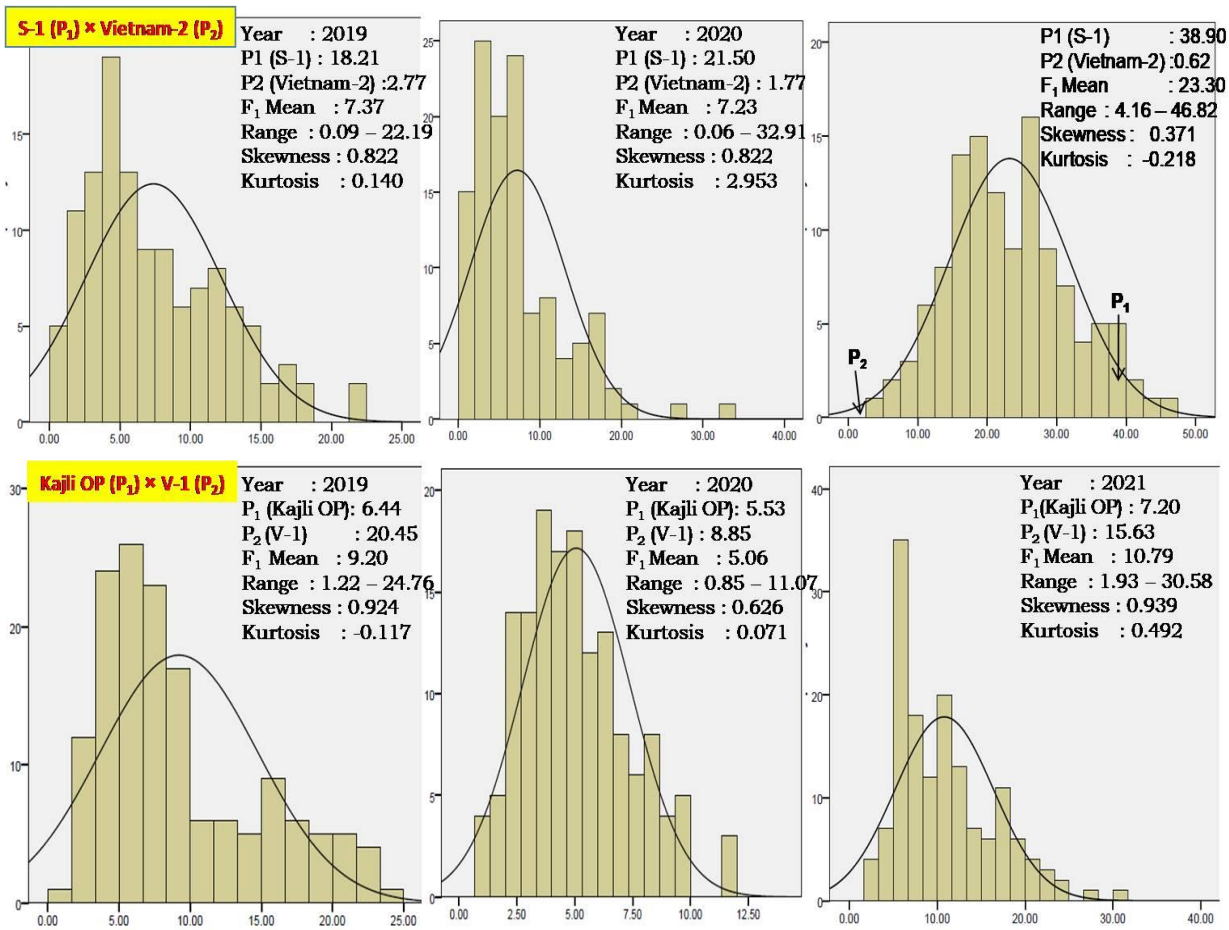
Name	Pooled Data [2019-2021]			Year [2021]		
	R/S	Range	N	R/S	Range	N
S-1 x Vietnam -2	R	3.90- 4.75	5	R	< 4.15	1
	[38]	5.14 - 9.98	33	[6]	6.27-9.85	5
	S	10.24-19.81	73	S	10.75-19.92	43
	[82]	20.10-24.76	9	[114]	20.32-46.82	71
V-1 x Kajli OP	R	3.29 - 4.94	18	R	1.93- 4.89	11
	[107]	5.11- 9.98	89	[76]	5.01-9.95	65
	S	10.04 - 15.09	43	S	10.06-19.43	63
	[43]			[74]	20.17-30.58	11

R: Resistant; S: Susceptible; N: No of progenies

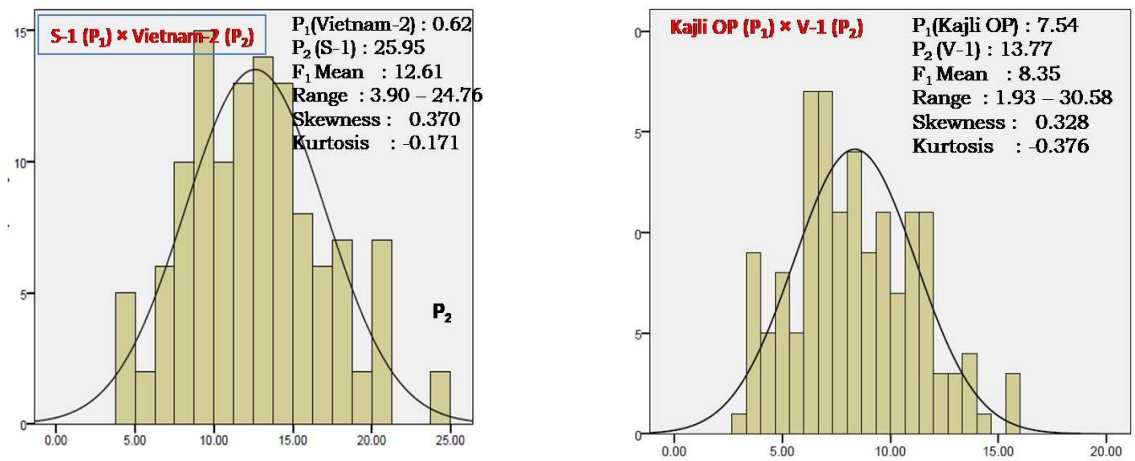
Two pseudo F_2 population of S-1 × Vietnam-2 (3.90 – 24.76) and V-1× Kajli OP (3.29-15.90) recorded wider range for powdery mildew disease severity (PDI). Both the populations recorded fivefold variation in powdery mildew incidence under natural epiphytic condition. The S-1 × Vietnam -2 exhibited distinctive disease response patterns as observed in frequency distribution curve and six progenies were observed to be resistant. Estimated coefficients of skewness and kurtosis revealed positively skewed and

platykurtic distribution indicated relatively large number of segregating genes and complementary type of interaction implying stringent selection are to be deployed for disease improvement

Frequency distribution of powdery mildew disease (PDI) in pseudo F2 population



Frequency distribution of mean powdery mildew disease (PDI)



Phenotyping of V-1× Kajli OP population revealed both susceptible and resistant individuals for powdery mildew disease and wider variation (3.29 -15.09 PDI). The moderately resistant Kajli OP and highly susceptible V-1 along with their F1 progenies exhibited distinctive disease response patterns as observed in frequency distribution curve and eighteen progenies were observed to be resistant. Estimated coefficients of skewness and kurtosis revealed positively skewed and platykurtic distribution indicated

relatively large number of segregating genes and indicate a dominance based complementary epistasis gene action provides an opportunity for selecting superior segregant. Further, the Chi-square analysis for Kajli OP × V-1 during higher incidence period (2021) revealed 1: 1 segregation for powdery mildew disease.

Inference: Phenotypic data of powdery mildew disease seveity revelaed five fold variations in both the population and non significant association of CHS CAPS marker reported to be associated with the powdery mildew resistance. Identified MLO2 and MLO6A as candidate genes involved in powdery mildew susceptibility and alternative splicing of MLO genes resulting in truncated proteins in powdery mildew tolerant accessions of mulberry.

Future work plan: Identified MLO2 and MLO6A may be knocked down through genome editing approach to develop powdery mildew resistant varieties.

On-going Projects

PIE 02002 SI: Evaluation of performance of mulberry genotype C-9 under red and laterite soils.

[July, 2019 to June, 2023]

Suresh, K., (PI) Soumen Singh, D.K. Gogoi and In-charge REC, Bhandra.

Objective:

- To assess the performance of C-9 under red & lateritic soils of Eastern and North-Eastern India.

Test genotype (C-9 or C-2058) along with two check varieties (S-1 & C-2038) were evaluated for leaf productiitvty and quality along with insect-pest and disease incidence under rainfed red- laterite soils and north-eastern region. The experimental seasonal crop production was carried out with recommended agronomic practices of rainfed condition. In rainfed red - laterite soils, C-9 recorded 15% higher mean seasonal leaf yield over C2038 (4.37 t/ha). The annual leaf yield (t/ha) was highest in C-9 (15.15) followed by C-2038 (13.11) and S-1 (10.01). The higher leaf yield performance of C-9 was attributed to more leaves per meter length and total shoot length per plant. In NE region, C-9 recorded higher mean seasonal (8.85 t/ha) and annual leaf yield (26.55 t/ha) which was higher than C-2038(9%) and S-1(56%). Insect-pests e.g. Whitefly, thripa and Mealybug infestation and foliar disease incidence was reported below ETL and check C2038.

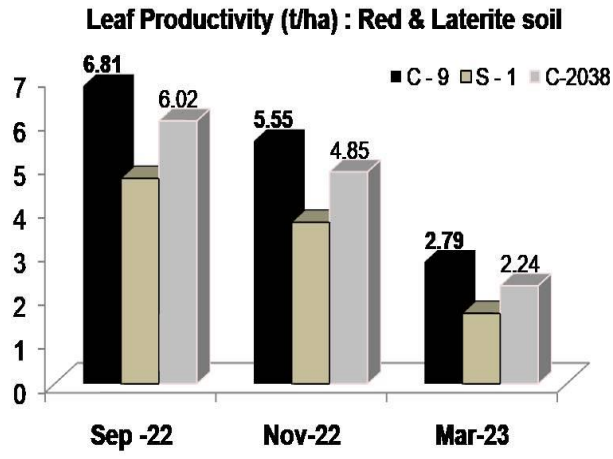
Leaf quality and productivity under rainfed red and laterite soil

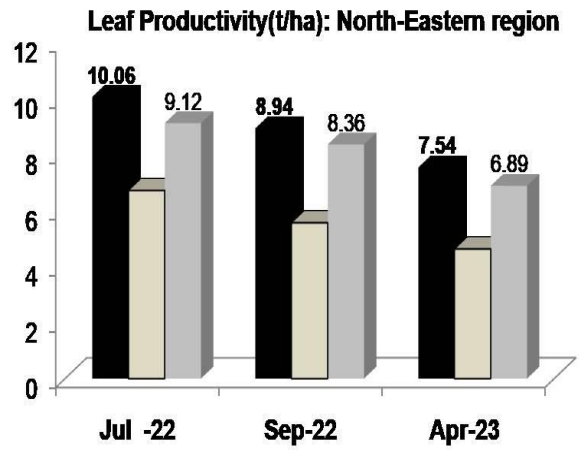
Genotype	FLW	ULA	LMC	MRC	LMS	LLS	NPS	TSL	LYP
C-9	3.635*	269.30	75.67	91.38*	21*	127*	10.26*	803*	20.05*
S-1	2.343	173.45	72.79	83.92	22	113	9.06	561	13.25
C2038	4.270	310.71	76.74	88.53	19	102	8.26	653	17.35
CD@5%	0.301	16.73	0.86	1.66	1	6	0.81	61	1.13

Leaf quality and productivity under rainfed condition in North-Eastern region

Genotype	FLW	ULA	LMC	MRC	LMS	LLS	NPS	TSL	LYP
C-9	5.085	302.98	75.66*	93.11	25*	205*	10.40*	1211*	37.72*
S-1	2.968	163.60	72.86	90.15	23	153	8.67	1018	24.39
C2038	5.897	332.75	74.51	92.55	23	182	9.37	1050	34.70
CD@5%	0.129	7.99	1.00	1.87	1	4	0.28	58	0.87

FLW: Fresh leaf weight (g); ULA: Unit Leaf area (cm^2); LMC: Leaf moisture content (%); MRC: Moisture retension capacity@6hrs (%); LMS: Leaves per meter shoot (No.); LLS: Length of longest shoot (cm); NPS: No of primary shoots per palnt(No); TSL: Total shoots length (cm) and LYP: Leaf yield per plot (kg).





PIE 13001MI: All India Co-ordinated Experimental Trial for Mulberry varieties-Phase-IV.

[April, 2019 to March, 2024]

Kishor Kumar, C.M. (ZC), Suresh, K. (Co-PI), CIs:Y. Debraj, Karthik Neog, Dip Kr. Gogoi, Irfan Ilahi, Ram Mina, Biswabasu Bagchi, FCs: Pooja Makwana, Yallappa, H. Khasru Alam, Deepika, K.U., Ranjita Devi, Shafi Afroz and S. Chakraborty.

Objective:

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

Candidate mulberry varieties CBP1, CMY1 & CPP1 along with two check varieties C2038 & S1635 were evaluated for leaf productiitvty and moisture quality along with Insect-pests and disease incidence at eight centers in the Eastern Zone under the coordination of CSRTI-Berhampore. Test genotypes and check varieties were evaluated under one irrigated and seven rainfed test centers of Eastern and North-eastern states. Silwkrom bioassay was also carried out with B.Con1 x B.Con4 hybrid during autumn crop 2022 under irrigated conditions. The experimental plantation was mainatained with recommended agronomic practices for seasonal crop assement as given below.

Mulberry crop schedules in Eastern Zone

Test center	Plantation date	Seasons /Crops				
		1st	2nd	3rd	4th	5th
CSRTI-Berhampore	25.10.2019	May-Jul [Early Kharif]	Jul-Sep [Late Kharif]	Sep-Nov [Autumn]	Jan- Feb [Spring]	Mar-May [Summer]
BSF-A'falakata	09.11.2019	Jul-Sep [Autumn]	Jan- Mar [Spring]	Apr-June [Summer]		
RSRS-Jorhat	03.11.2019	Jul-Sep [Autumn]	Jan- Mar [Spring]	Apr-Jun [Summer]		
RSRS-Imphal	04.11.2019	Jul-Sep [Autumn]	Feb- Apr [Spring]	May- Jul [Summer]		
DOS-Boswa	04.11.2019	Jul-Sep [Kharif]	Sep-Nov [Autumn]	Jan - Mar [Spring]		
DoS-Bilaspur	22.07.2019	Jun –Aug [Kharif]	Aug- Oct [Autumn]	Nov- Feb [Spring]		
REC-Bhandra	08.08.2019	Jun-Aug [Kharif]	Aug-Oct [Autumn]	Jan- Mar [Spring]		
RSRS-Koraput	20.07.2019	Jul-Sep [Kharif]	Sep-Nov [Autumn]	Jan – Mar [Spring]		

Irrigated Condition (CSRTI-Berhampore)

In second year of evaluation, four seasonal performances of test genotypes for leaf and cocoon yield were assessed. During 2022-23, C2038 recorded highest mean seasonal leaf yield (6.58 t ha^{-1}) followed by CBP1 (6.18 t ha^{-1}), CMY1 (5.87 t ha^{-1}), S1635 (5.15 t ha^{-1}) and CPP1 (3.92t ha^{-1}). Maximum seasonal leaf yield of 8.5 t ha^{-1} was recorded in CMY1 during September, 2022 season and lowest in February, 2023 season. CBP1 was observed to be highly resistant to powdery mildew disease and insect pests infestation compared to check C2038. Silkworm bioassay revealed, CMY1 leaves fed B.Con1 × B.Con4 hybrid produced 9% highest cocoon yield (62.9 kg) compared to C2038 (57.7 kg) followed by CPP1(61.7 kg), S1635 (60.7 kg) and CBP1 (58.4 kg). CMY1 fed cocoons recorded significantly higher larval weight, single cocoon and shell weight along with ERR by weight. CMY1 recorded lowest leaf to cocoon ratio (18.1) followed by CPP1 (18.8), C2038 (19.8), CBP1 (20.3) and S1635 (21.8) indicating superior quality of leaves.

Growth traits and leaf productivity under irrigated condition

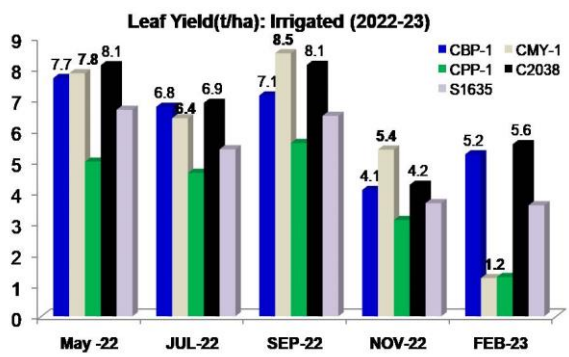
Genotype	DSN	DSW	HLW	MLA	LMS	LLS	TSL	SYP	LSR	LYP
CBP-1	8	47	314.70	165.20	21	132	1237*	49.92	55.22	27.57
CMY-1	9	79	305.33	152.61	24*	112	1083	47.72	60.73*	29.55
CPP-1	10	76	335.96	163.76	21	132	884	33.87	58.61	20.29
C-2038*	8	48	363.81	189.46	21	133	1175	51.41	58.83	29.78
S-1635	7*	45	248.08	134.87	22*	127	1072	43.38	53.20	23.54
CD@5%	1	2	18.95	11.83	1	4	33	0.98	1.36	0.62
CV (%)	12.41	15.67	21.27	19.37	10.45	16.21	13.62	14.06	6.83	16.77

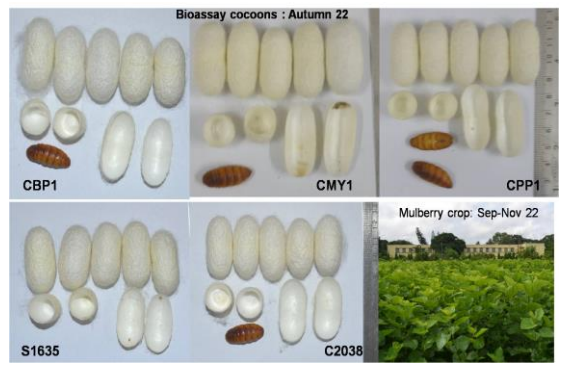
DHS: Days to 100% sprouting in N: Normal; W: winter; HLW: Hundred leaf weight (g); MLA: Mean Leaf area (cm^2); LMS: Leaves per meter shoot (No.); LLS: Length of longest shoot (cm); TSL: Total shoots length (cm); SYP: Shoot yield per plot (kg); LSR: Leaf to shoot ratio (%) and LYP: Leaf yield per plot (kg).

Leaf quality and Insect pest –Disease severity under irrigated condition

Genotype	TSP	TSS	CCI	LMC	MC6	WTF	THP	TKI	BLS	PMS	PMI
CBP-1	35.36*	43.65	20.08*	79.28*	76.22*	9.10	12.65	7.24	2.53	7.80*	1.71*
CMY-1	33.34	43.29	15.74	78.44*	75.11*	10.64	13.86	7.12	2.50	29.60	29.69
CPP-1	34.44	40.23	14.11	77.79	73.88	12.53	11.47	8.22	1.92	22.83	18.21
C-2038*	34.32	44.21	17.89	77.60	73.62	9.53	13.59	7.06	2.07	39.66	41.70
S-1635	30.50	39.96	23.73*	76.28	73.75	13.88	17.29	9.64	3.08	35.74	34.51
CD@5%	0.98	1.05	1.09	0.65	0.71	1.52	0.79	1.66	0.38	1.67	2.70
CV(%)	7.84	7.44	13.72	1.99	2.10	18.65	17.53	20.27	7.54	10.78	14.65

TSP: Total Soluble protein(mg/g); TSS: Total sugars(mg/g); CCI:Chlorophyll Content index, LMC: Leaf moisture content (%); MC6: Leaf moisture content@6 hrs(%); WTF:Whitefly(No/leaf); THP: Thrips(No/leaf); TKI: Tukra Infestation(%); BLS: Bacterial Leaf spot(PDI), PMS: Powdery mildew severity(PDI) and PMI: Powdery mildew Infestation(%)





Cocoon traits and yield in autumn 2022: B.Con1 ×B.Con4 bioassay

Genotype	MLW	TLD	SCW	SSW	SWR	ERR No	ERR Wt.	CYH	LCR
CBP1	3.483	28	1.638	0.269	16.52	9637	14.59	58.37	20.35
CMY1	4.117*	29	1.778*	0.292*	16.44	9502	15.75*	62.99*	18.10*
CPP1	3.742	30	1.713	0.282	16.45	9780*	15.42	61.68*	18.79*
C-2038*	3.442	28	1.571	0.255	16.27	9579	14.44	57.75	19.85
S-1635	3.800	27	1.698	0.269	15.86	9766	15.18	60.71	21.76
CD 5%	0.157	1	0.080	0.011	0.25	154	0.51	2.07	0.38
CV (%)	7.42	4.40	5.60	5.58	2.92	1.67	4.15	4.15	8.25

MLW: Mature larval weight(g); TLD: Total Larva duration(days); SCW: Single cocoon weight(g); SSW: Single shell weight(g); SRP: Shell weight ratio (%); ERR : Effective rate of rearing in No & gram CYH: cocoon yield per100 DFL (kg), LCR: leaf to cocoon weight ratio (%)

Silk parameters in autumn 2022: B.Con1 × B.Con4 bioassay

Geno types	TFL (m)	NBL (m)	RSP (%)	SRP (%)	RLP (%)	DNR	RND	NTS (%)
CBP1	730	711	12.66	77.32	80.39	2.60	7.91	93
CMY1	758*	754*	12.88*	78.75*	81.98	2.63	7.98	94*
CPP1	708	696	12.58	77.16	80.67	2.75*	8.00	92
C2038*	723	713	12.50	75.77	82.13	2.63	7.81	91
S1635	689	689	12.21	74.84	80.56	2.57	8.20	90
CD 5%	24	23	0.32	2.55	0.99	0.10	0.25	3
CV (%)	5.54	5.48	2.69	3.01	1.35	3.60	2.93	3.06

TFL: Total Filament length (m); NBL: Nonbreakable Filament length (m); RSP: Raw silk (%); SRP: Silk recovery (%); RLP: Reelability9%); DNR: Denier; RND: Rendita; NTP: Neatness (%)

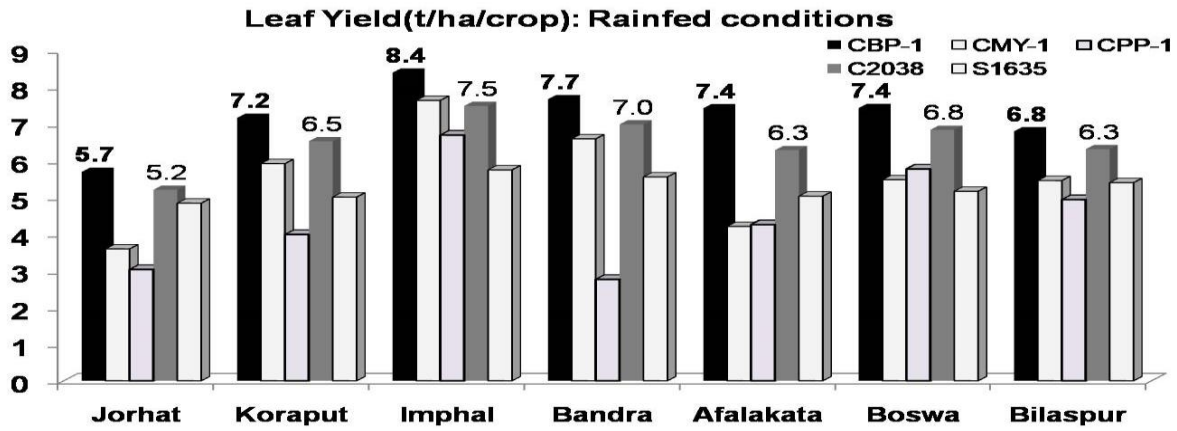
Rainfed Condition (Seven centers):

Three test genotypes and checks were also evaluated for leaf productivty and quality under seven rainfed conditions of Eastern & North-Eastern states. Mean seasonal leaf yield of all genotypes varied from 4.47 t ha^{-1} (Jorhat) to 7.20 t ha^{-1}(Imphal). CBP1 recorded 10% higher leaf yield (7.23 t ha^{-1}) over check C2038 (6.52 t ha^{-1}) under rainfed conditions. CBP1 recorded significantly higher longer shoots, total shoots length and shoot yield compared to C2038. The insect-pests mealybug and whitefly infestation along with bacterial and *Myrothecium* leaf spot disease were noticed which were below ETL.

Leaf moisture quality and productivity under rainfed conditions

Genotype	DSN	LMC	LM6	MRC	LMS	LLS	TSL	SYP	LSR	LYP
CBP-1	10	77.78	74.62	88.03	20	163*	968*	1161*	54.95	28.70*
CMY-1	12	78.32*	74.66	86.64	24*	126	761	812	61.94	22.06
CPP-1	13	76.90	72.96	86.45	19	140	673	732	53.67	17.84
C-2038*	10	77.16	73.58	88.15	19	152	904	924	62.72	25.89
S-1635	9	76.93	73.31	85.58	20	147	823	861	51.95	20.84
CD@5%	1	1.14	1.31	1.35	1	10	55	63	1.72	1.38
CV (%)	18.84	2.23	2.56	3.17	12.23	13.13	17.75	18.66	11.98	20.44

DHS: Days to 100% sprouting in Normal seasons; LMC: Leaf moisture (%); MC6: Leaf moisture @6 hrs(%); MRC: Moisture retension capacity(%); LMS: Leaves per meter shoot (No.); LLS: Length of longest shoot (cm); TSL: Total shoots length (cm); SYP: Shoot yield per plant (g); LSR: Leaf to shoot ratio (%) and LYP: Leaf yield per plot (kg).



PIB 02010 SI: Final yield trial of promising high yielding mulberry genotypes for Eastern and North-Eastern India.

[February, 2021 to January, 2025]

Suresh, K. (PI), Yallappa, H., Deepika, U.K. and Dip Kr. Gogoi.

Objectives:

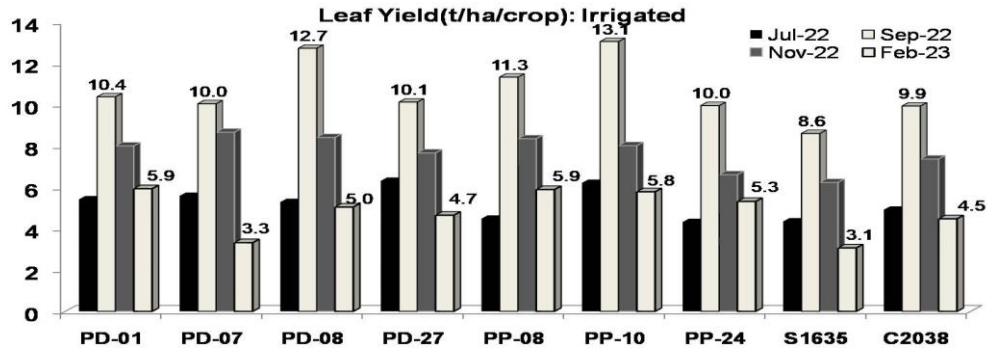
- To evaluate improved mulberry genotypes for growth traits and leaf productivity.
- To assess the leaf quality by biochemical and silkworm bioassay.

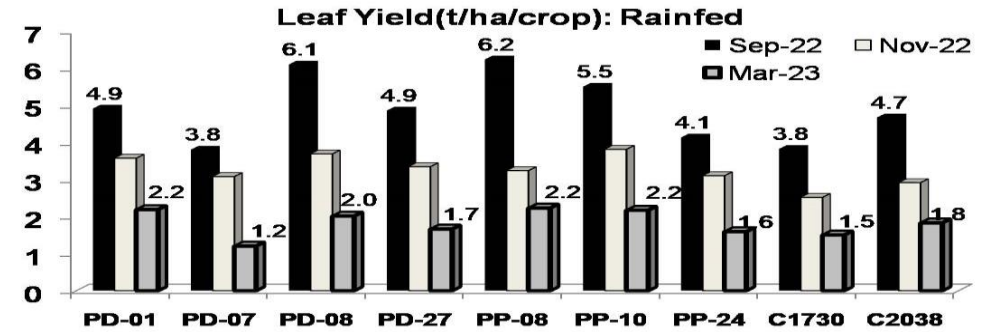
Seven test genotypes (Drought tolerant : PD-1, PD-7, PD-8 & PD-27 and Physiological growth: PP-8, PP-10 & PP-24) along with two check varieties (S-1635/C-1730 & C-2038) were evaluated for leaf quality and productivity under irrigated (Berhampore) and rainfed condition (Korput). The plantation is being maintained with recommended agronomic practices different crop seasons as per local commercial crop schedules. In irrigated condition, six genotypes recorded 3-24% higher mean seasonal leaf yield over check C2038 (6.68 t/ha). The test genotypes had medium to high soluble protein and sugar content along with lower insect-pests infestation compared to both checks. Genotype PD27 was observed to be higly susceptible to root rot disease.

Growth traits and leaf productivity under irrigated condition

Genotype	DSN	DSW	HLW	LMC	LM6	LMS	LLS	TSL	SYP	LSR	LYP
PD-01	9	44*	596.6*	78.47*	75.22*	19	146*	940*	45.88	59.67	25.72*
PD-07	11	45*	382.1	79.30*	75.77*	24*	143*	892	46.37*	62.41	26.25*
PD-08	8*	49	491.2	77.44*	74.34*	22*	135	890	52.63*	60.60	28.55*
PD-27	10	48	445.9	77.41*	73.91	21	146*	952*	49.30*	57.76	26.04*
PP-08	8*	42*	301.7	76.87*	72.41	22*	123	901	52.32*	60.66	26.11*
PP-10	8*	40*	437.7	78.23*	74.31*	21	122	883	53.11*	62.73	29.48*
PP-24	9	40*	443.6	77.03*	72.47	19	135	950*	41.08	59.63	22.57
S-1635	8	43*	373.3	77.67*	72.88	20	135	909	44.14	52.88	20.74
C-2038*	9	48	504.3	75.71	73.38	20	127	891	44.92	61.62	24.00
CD@5%	1	2	54.8	0.99	0.90	1	8	44	2.39	2.59	1.16
CV (%)	13.7	7.18	23.12	1.69	1.94	7.55	11.04	11.77	14.74	6.55	15.07

DHS: Days to 100% sprouting in N: Normal; W: winter; HLW: Hundred leaf weight (g); LMC: Leaf moisture (%); LM6: Leaf moisture @ 6 hrs(%); LMS: Leaves per meter shoot (No.); LLS: Length of longest shoot (cm); TSL: Total shoots length (cm); SYP: Shoot yield per plot (kg); LSR: Leaf to shoot ratio (%) and LYP: Leaf yield per plot (kg).





Leaf quality and Insect pest isease severity under irrigated condition

Genotype	TSP	TSS	CCI	PMS	ROT	TKI	BHC
PD-01	33.77*	40.29	14.58	23.74*	2.93*	19.89	15.72
PD-07	32.52	41.22*	20.09*	26.51*	12.11	26.69	1.88
PD-08	32.03	35.86	14.12	19.17*	17.11	15.92	3.87
PD-27	29.83	34.22	16.44	20.69*	71.94	27.23	0.29
PP-08	31.56	38.14	15.28	19.11*	14.88	12.93	1.57
PP-10	34.35*	38.28	13.45	19.55*	10.20	16.96	2.44
PP-24	31.70	36.84	15.75	25.28*	9.52	12.82	1.69
S-1635	29.17	37.85	20.67	28.94	11.86	34.16	31.03
C-2038*	31.52	39.27	17.12	35.53	7.49	17.38	3.86
CD@5%	1.57	1.03	1.82	2.86	3.02	6.70	1.13
CV(%)	7.01	9.07	20.46	23.42	22.89	42.88	23.51

TSP: Total Soluble protein (mg/g); TSS: Total sugars (mg/g); CCI: Chlorophyll Content index, PMS: Powdery mildew severity (PDI); ROT: Root rot infesataion (%); TKI: Tukra Infestation (%) and BHC: Bihar Hairy caterpillar infestation (%)

In rainfed condition, five genotypes recorded 5-25% higher mean seasonal leaf yield over check C2038 (3.14 t/ha). Genotype PD-1, PD-08, PP-08 & PP-10 recorded >10 higher leaf yield over check C2038 alongwith lower insect-pests infestation. These genotypes observed to have significantly higher leaf moisture content, leaves per meter length, longer shoots and total shoots length.

PPA 02005 SI: Optimization of spacing and nutrient dose for newly developed high yielding mulberry variety C-2038 under irrigated condition.

[October, 2019 to September, 2023]

Yallappa Harijan (PI), Suresh, K. and Deepika, K. U.

Objective:

- To find out the optimum spacing and level of fertilizer for higher leaf productivity and better leaf quality under irrigated condition for the high yielding mulberry variety, C2038.

Mulberry Variety Authorization Committee (MVAC) of CSB has authorized the high yielding mulberry variety C-2038 for irrigated & rainfed areas of India. C-2038 is an improved mulberry variety having 20-25 % higher leaf yield potential (53-55 t/ha/yr) over S-1635. The recommended dose of nutrients for cultivation of existing variety (S-1635) under irrigated condition is NPK: 336:180:112 kg/ ha/ yr (2'×2'). The present investigation was undertaken to determine the optimum dose of nutrients and spacing for high leaf productivity and quality in new mulberry variety C-2038. Twenty treatments with four different spacing (S1: 2'×2', S2: 3'×3', S3: PRS & S4: 6'×6') and five nutrient doses [N1:75% RDF (252:135:84); N2: 100% RDF (336:180:112); N3:110% RDF (370:198:123); N4: 120% RDF (403:216:134) & N5:130% RDF (437:234:146 N:P2O5:K2O Kg/ha/yr) were evaluated for leaf yield and quality traits in Strip plot design during five seasons under irrigated condition.

Pooled mean data over five seasons revealed C-2038 cultivation under 2'×2' spacing with 120% RDF recorded highest leaf yield (68.50 t/ha) compared to recommended dose/control (59.52 t/ha) along with higher total soluble protein (41.31 mg/g fw), sugar (38.64 mg/g fw) and leaf moisture (72.80%). C-2038 recorded 15 % higher leaf yield under 120% RDF with 2'×2' spacing compared to control (100% RDF). The improved leaf yield under 120% RDF is due to higher productive shoots per plant, more total shoots length, more fresh leaf weight, chlorophyll content index, & specific leaf area. Further, disease and pest severity assessment in different seasons revealed lower incidence of Bacterial Leaf spot (3.76 PDI) & *Myrothicium* LS (3.37 PDI), powdery mildew (5.18 PDI), thrips (7.21/leaf), whitefly (11.50/leaf) & tukra infestation (16.57%). Further, there was significant reduction in leaf yield under 10% reduced application of RDF across all spacing's.

Percentage of yield advantage in increased dose of RDF under four different spacing

Nutrient doses ($N:P_2O_5:K_2O$, Kg/ha/yr)	Spacing	FLW (g)	SLA (cm^2/ g)	LMC (%)	CCI	TSP (mg/g FW)	TSS (mg/g FW)	NPS (No.)	LMS (No.)	TSL (cm)	LFH (%)	ALY (t/ha/ yr)
252:135:84 [75% RDF]	2'×2'	3.70	196	72.28	17.06	39.00	37.23	8.22	20.01	691	15.13	57.72
	3'×3'	3.57	201	72.18	16.96	40.65	37.49	9.96	20.68	852	13.51	38.16
	PRS	3.72	196	71.94	17.58	42.56	38.92	9.56	20.33	788	13.38	38.01
	6'×6'	3.95	180	72.89	20.31	44.45	43.08	12.02	20.22	1061	11.06	15.21
336:180:112 [100% RDF]	2'×2'	3.95	186	72.77	17.89	39.73	40.28	8.29	20.67	696	15.49	59.52
	3'×3'	3.64	200	73.17	17.26	39.89	31.95	10.33	21.20	886	14.57	43.64
	PRS	3.72	194	72.87	16.71	42.67	43.25	9.53	20.39	805	14.15	42.24
	6'×6'	3.88	195	72.53	17.87	44.57	40.45	14.09	20.96	1276	11.70	17.78
370:198:123 [110% RDF]	2'×2'	3.96	173	72.26	17.70	40.29	40.58	8.56	20.54	744	15.02	60.75
	3'×3'	3.85	187	72.49	18.41	41.17	39.46	10.78	19.64	987	12.93	46.82
	PRS	3.94	170	71.91	18.24	41.66	41.68	9.76	20.44	835	13.33	45.19
	6'×6'	4.00	180	72.14	20.19	42.15	44.56	14.20	20.94	1294	10.76	18.97
403:216:134 [120% RDF]	2'×2'	4.01	195	72.80	19.03	41.31	38.64	8.85	20.82	742	14.29	68.50
	3'×3'	4.13	198	73.10	18.25	42.01	39.50	11.09	20.70	1110	13.68	50.71
	PRS	4.09	180	72.30	19.35	42.68	41.37	10.52	20.29	942	12.23	49.42
	6'×6'	4.54	171	73.05	21.05	46.36	45.56	14.79	20.12	1402	10.98	21.84
437:234:146 [130% RDF]	2'×2'	3.99	195	72.59	20.88	42.03	39.06	8.65	20.67	811	14.46	66.83
	3'×3'	4.17	202	74.11	19.20	42.69	36.49	11.24	20.60	1022	13.18	48.91
	PRS	4.03	179	71.60	19.27	44.16	41.32	10.31	19.74	925	13.54	49.78
	6'×6'	4.20	181	72.87	21.68	45.30	45.16	14.66	20.37	1368	11.41	22.12
CD 5%		***0.10***	***4.90***	***0.26***	***0.69***	***0.91***	***1.52***	***1.00***	***0.19***	***105.03***	***0.68***	***7.70***

FLW: Fresh leaf weight; TSL: Total Shoot length/plant; LMS: No. of leaves/meter length of shoot; NPS: No. of primary shoots/plant; SLA: Specific Leaf Area; TSS: Total soluble sugar; TSP: Total Soluble Protein; LMC: Leaf Moisture Content; CCI: Chlorophyll content index; LFH: leaf fall at harvest; LYP: Leaf yield per plant & Annual leaf yield (t/ha/year)

Percentage of improvement of leaf yield (t/ha/yr) over RDF under different spacing of C2038								
Nutrient doses ($N:P_2O_5:K_2O$; Kg/ha/yr)	2′×2′	% gain	3′×3′	% gain	PRS	% gain	6′×6′	Gain %
N_1: 252:135:84 (75% RD)	57.72	-3.02	38.16	-12.56	38.01	-10.01	15.21	-14.45
N_3: 370:198:123 (110% RD)	60.75	2.07	46.82	7.29	45.19	6.98	18.97	6.69
N_4: 403:216:134 (120% RD)	68.50	15.09	50.71	16.20	49.42	17.00	21.84	22.83
N_5: 437:234:146 (130%RD)	66.83	12.28	48.91	12.08	49.78	17.85	22.12	24.41
N_2: 336:180:112 (Control)	59.52		43.64		42.24		17.78	

PIB 02007 SI: Improvement of mulberry leaf longevity in Eastern & North Eastern states of India.

[June, 2020 to May, 2024]

Deepika, K.U. (PI), Yallappa, H. and Harish Babu, S.

Objectives:

- To understand hormonal regulation of senescence in mulberry genotypes.
- To determine stay-green traits for improved mulberry leaf longevity.

The present study aims at understanding the hormonal regulation of senescence in mulberry and determining the role of hormones in maintaining stay-green traits for improving leaf longevity. This project envisages at manipulating different plant growth regulators, nutrients & bioactive substances and evolves formulation for enhancing leaf longevity irrespective of seasons & variety. Different plant growth regulators (4), nutrients (4) & bioactive substances (2) were investigated for their role (alone and in combinations) in improving leaf longevity under floating leaf disc assay. BAP, SNP, BAP+IAA & BAP+AA based formulations were found to be most effective in delaying senescence by retaining more than 85% chlorophyll compared to control (34 %) in both S-1635 and C-2038. These four treatments were further tested along with control (H_2O) and two commercial formulations (Morizyme-B & Poshan) on potted mulberry plants (S-1635 & C-2038).

Pot culture studies:

Mean crop data of two varieties (S-1635 & C-2038) for exogenous application of BAP, SNP, BAP+IAA & BAP+AA based formulations on potted plants of mulberry for five crop seasons (Feb-22, May-22, July-22, Sep.-22 & Nov.-22) revealed that BAP+AA based formulation was able to significantly improve leaf longevity (40.8 %), leaf yield (43.2 %) & also quality over control in both the varieties. This newly developed formulation was also found to be better when compared to the commercial formulations (Morizyme B & Poshan) and other developed formulations.

Leaf Longevity, Leaf quality & Leaf Yield related Traits

Treatments	LLS (cm)	LA (cm^2)	LF (%)	LY (g/plant)	NDVI (index)	TCC (mg/g FW)	TSP (mg/g FW)
BAP	103.4 *	225.9 *	18.2 *	235.5 *	0.62 *	2.35 *	35.0 *
BAP+IAA	98.3 *	206.2 *	21.3 *	213.7	0.57 *	2.02 *	32.1 *
BAP+AA	110.0 *	240.0 *	17.8 *	256.6 *	0.69 *	2.38 *	35.8 *
SNP	105.9 *	224.9 *	16.7 *	250.5 *	0.65 *	2.24 *	34.3 *
Morizyme	93.5	195.7	22.3 *	198.4 *	0.53	1.99 *	32.0 *
Poshan	95.3	199.8 *	23.1	196.5 *	0.51	1.81	29.6
Control	87.4	180.8	27.7	179.1	0.49	1.68	27.1
CD at 5%	9.7	18.7	5.4	15.3	0.05	0.2	2.8
CV (%)	5.4	5.7	7.7	7.1	6.8	5.5	6.0

(LLS: Length of Longest Shoot, LA: Leaf Area, LF: Leaf Fall, LY: Leaf Yield, NDVI: Normalized Difference Vegetation Index, TCC: Total Chlorophyll Content & TSP: Total Soluble Protein)

Field studies:

The newly developed BAP+AA based formulation was further evaluated under field conditions in the existing plantations of different varieties (S-1635, C-2038 & C-2060) at CSR&TI-Berhampore (Nov., 22 & Feb., 23). Mean data of two crops for three varieties shown promising improvement in leaf longevity (36.4%) & leaf yield (19.2%) over control and the two commercial formulations (Poshan & Morizyme B).

Field trials were also initiated at RSRS-Kalimpong (March, 23) in existing plantation of BC_2-59 for testing their role in improving mulberry leaf longevity. Expression studies for senescence associated genes and estimation of hormone content in leaf is under progress.

PIE 02013 SI: Final yield Trial of newly identified mulberry genotypes for leaf productivity and quality.

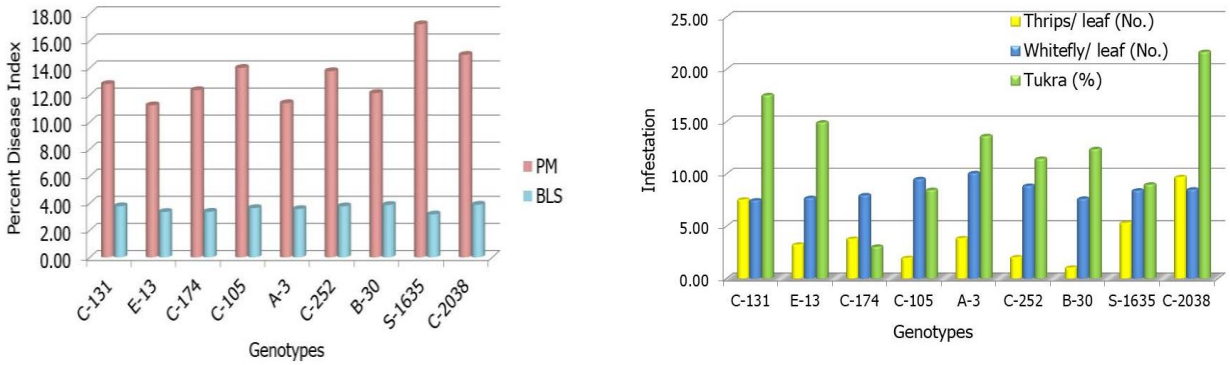
[December, 2021 to November, 2024]

Yallappa Harijan (PI), Suresh, K., Deepika, K.U. and Khasru Alam.

Objectives:

- To evaluate selected mulberry genotypes for leaf yield & quality traits.
- To assess silk productivity by silkworms with test genotypes.

Selected four triploids (C-105, C-252, C-174 & C-131) and three high NRA (B-30, E-13 & A-3) genotypes along with two check varieties (S1635 & C2038) were evaluated for growth and leaf yield traits for five seasons under irrigated condition. Mean leaf yield varied from 37.58 to 45.72 t/ha compared to check varieties S1635 (33.95 t/ha) & C2038 (38.71 t/ha). Three test genotypes C-131, E-13 and C-174 recorded 13-18% higher leaf yield over C-2038. Annual performance of test genotypes found significantly higher for most of the growth & quality traits. The improved leaf yield among test genotypes was due to higher longer shoots, more productive shoots, less leaf fall and more leaves per meter length. The biochemical assay revealed better nutritive and moisture quality among superior genotypes which was at par with check C-2038. The highest total soluble sugar was recorded in C-252 (42.20 mg/g fw) and protein in E-13 (40.18 mg/g fw). The thrips population varied from 1.03 to 7.53 thrips/ leaf, whitefly (7.46 to 10.06 per leaf), Tukra percentage varied from 3.03 to 17.51. The percent bacterial leaf spot index varied from 3.35 to 3.80 & powdery mildew from 11.23 to 14 PDI and lower population was noticed in all the test genotypes. Three genotypes C-131, E-13 & C-174 recorded more than 13% higher leaf yield in comparison to check C2038 with better leaf quality and lower pest infestation.



Incidence of pests and diseases among test genotypes in different crop seasons

Annual performance of leaf yield & quality traits under irrigated condition (5 crops)

GN	NPS	TSL	LMS	SLA	LMC	CCI	TSS	TSP	LY/ha	% gain (C2038)
C-131	11.32^{ab}	1119^{ab}	21.35^{ab}	217^{b}	72.92	18.46^{b}	37.06	38.51^{a}	45.72^{ab}	18.11
E-13	11.43^{ab}	1176^{ab}	22.01^{ab}	230^{b}	75.32^{b}	17.41^{b}	37.13	40.10^{a}	44.72^{ab}	15.53
C-174	11.63^{ab}	1031	20.45	218^{b}	74.40^{b}	16.97^{b}	38.16^{a}	39.50^{a}	43.83^{ab}	13.23
C-105	10.71	1132^{ab}	22.83^{ab}	265^{ab}	76.88^{a}	17.80^{b}	40.15^{a}	39.10^{a}	41.90^{ab}	8.24
A-3	11.27^{a}	1123^{ab}	21.97^{ab}	237^{ab}	75.81^{b}	16.93^{b}	38.81^{a}	37.09^{a}	40.56^{a}	4.78
C-252	11.58^{ab}	1152^{ab}	22.49^{ab}	240^{ab}	74.76^{b}	17.56^{b}	42.20^{ab}	38.21^{a}	39.66^{a}	2.45
B-30	11.28^{a}	1122^{ab}	21.62^{ab}	235^{ab}	76.00^{b}	17.29^{b}	36.26	37.31^{a}	37.58^{a}	-
^{a}S-1635	10.92	995	20.11	217	75.40	18.51	36.00	35.78	33.95	
^{b}C-2038	11.05	1003	20.53	198	73.20	15.79	39.46	40.17	38.71	
CD (5%)	***0.23***	***51.46***	***0.73***	***14.6***	***1.00***	***0.64***	***1.55***	***1.14***	***2.89***	

NPS: No. of primary shoots/plant; LMS: No. of leaves/meter length of shoot; TSL: Total Shoot length/plant (cm); SLA: Specific leaf area (cm2/g); LMC: Leaf moisture content (%); CCI: Chlorophyll Content index; TSS: Total soulble sugar (mg/g fw); TSP: Total soluble protein (mg/g fw); LY/ha: Leaf yield per hector (t).

MOE 02015 MI: Evaluation of improved technologies developed in the field of mulberry sector for Eastern & North-Eastern India.

[February, 2022 to January, 2025]

Zonal Co-ordinator: Suresh, K., Scientist-C

Executive Authority: Kishor Kumar, C.M., Director

Deepika, K.U. (PI-CI), Suresh, K. (PI-CII). Yallappa, H. (PI-CIII), Rabha, M. (PI-CIV) & In-charges of RSRSs /RECs/Dos Units.

Component-I: Evaluation of promising bacterial leaf spot resistant & high yielding genotype C-2070 in E & NE States.

Objectives:

- To evaluate promising bacterial leaf spot resistant & high yielding genotype C-2070 in E & NE States.

Progress:

BLS resistant variety, C-2070 was tested along with two checks S-1635 & C-2038 was at six locations (Irrigated: CSRTI-Berhampore and REC-Mothabari; Rainfed: RSRS-Koraput, REC-Mamring, Mangaldoi and Dimapur). Annual crop data (5 crops: Feb-22, May-22, Jul-22, Sep-22 & Nov-22) of irrigated region (CSRTI-Berhampore and REC-Mothabari) revealed BLS resistant variety, C-2070 (45.5 t/ha) yielded on par with C-2038 (46.3 t/ha) and higher than S-1635 (40.1 t/ha). BLS disease incidence occurred during Jul.-Sep., 2022 and C-2070 (PDI-2.4) shown negligible incidence compared to C-2038 (PDI-8.1) and S-1635 (PDI-13.1).

BLS incidence, Growth & Yield Parameters at Irrigated Regions				
Genotype	BLS (PDI)	LY (t/Ha)	SY (t/Ha)	LA (cm^2)
C-2070	2.4*	45.5	12.5	200.6
C-2038	8.1*	46.3	12.0	233.4
S-1635	13.1*	40.1	15.6	195.4
CD 5%	5.2	NS	NS	NS
CV (%)	5.7	8.7	7.5	11.3

(Bacterial leaf spot, LY: Leaf yield, SY: Shoot Yield & LA: Leaf area)

Even in the rainfed region (RSRS-Koraput, annual crop data (3 crops: Mar-22, Aug-22 & Nov-22) for leaf yield revealed that C-2070 (14.1 t/ha) yielded on par with C-2038 (15.5 t/ha) and higher than S-1635 (11.5 t/ha). No BLS disease incidence was reported in RSRS-Koraput, REC-Mamring & REC-

Mangaldoi. But during Jul.-Sep., 2022 REC-Dimapur recorded BLS incidence. C-2070 shown no disease incidence whereas, C-2038 (PDI-3.0) and S-1635 (PDI-4.2) recorded some little incidence.

BLS incidence, Growth & Yield Parameters at Rainfed Regions				
Genotype	BLS (PDI)	LY (t/Ha)	SY (t/Ha)	LA (cm^2)
C-2070	NIL	14.1	3.8	171.5
C-2038	3.0*	15.5	3.5	198.1
S-1635	4.2*	11.5	4.7	150.5
CD 5%	1.1	NS	NS	NS
CV (%)	4.3	7.5	6.3	14.1

(Bacterial leaf spot, LY: Leaf yield, SY: Shoot Yield & LA: Leaf area)

Component-II: Evaluation of HY and Low temperature stress tolerant varieties C-2060 & C-2065.

Objective:

- To evaluate of HY and Low temperature stress tolerant varieties C-2060 & C-2065.

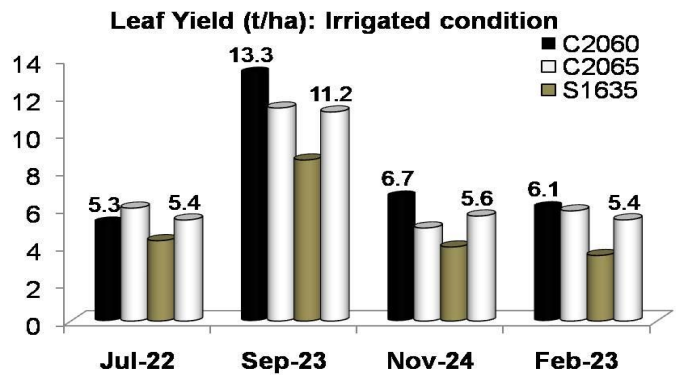
Progress:

Low-temperature stress (LTS) is one of the major abiotic stresses in subtopical region that affects mulberry leaf yield and quality during two commercial crop seasons. Mulberry varietiy with quick sprouting, early vigour, tolerant to LTS and higher winter yield is necessary for enhancing silk productivity. Two test genotypes (C-2060, C-2065) along with two checks S-1635 & C-2038 were evaluated under irrigated condition (Berhampore) and also being established in four rainfed centers (Jammu, Jorhat, Kalimpng & Sahaspur). The plantation was pruned as per local crop schedule and mainatained with recommended agronomic practices in irrigated condition. Four seasonal evaluation of test genotypes revealed, new genotypes C2060 & C2065 recorded 3-13% higher leaf productivity over C2038 (6.90 t/ha) along with lower incidence of tukra and myrothecium leaf spot disease. In winter seasons, C2060 recorded 15% higher leaf productivity over C2038 (5.51 t/ha) along with infestation and severity of powdery mildew disease.

Growth traits and leaf productivity under irrigated condition

Genotype	DSW	FLW	LMC	LM6	LMS	LLS	TSL	LFH	SYP	LSR	LYP
C2060	29*	2.895	77.52	72.43	24*	120*	676*	9.70*	24.18*	58.52	13.82*
C2065	32	2.749	77.75	72.73	24	99	564	11.44	20.50	61.41	12.48
S1635	34	2.559	76.88	72.57	23	98	496	14.26	16.99	56.92	8.99
C-2038*	38	3.858	77.07	72.57	22	104	592	11.54	20.10	62.31	12.18
CD@5%	1	0.370	1.14	1.29	1	6	38	1.06	1.64	4.00	0.98
CV (%)	9.67	22.15	1.80	2.24	6.41	8.10	9.79	15.65	15.06	8.61	16.49

DHS: Days to 100% sprouting in winter; FLW: Fresh leaf weight (g); LMC: Leaf moisture (%); LM6: Leaf moisture @6 hrs (%); LMS: Leaves per meter shoot (No.); LLS: Length of longest shoot (cm); TSL: Total shoots length (cm); LFH: Leaf fall at harvest(%); SYP: Shoot yield per plot (kg); LSR: Leaf to shoot ratio (%) and LYP: Leaf yield per plot (kg).



Component- III. Validation of the low cost drip fertigation system for mulberry cultivation at different locations.

Objective:

- To validate the low cost drip fertigation system for mulberry cultivation at different locations.

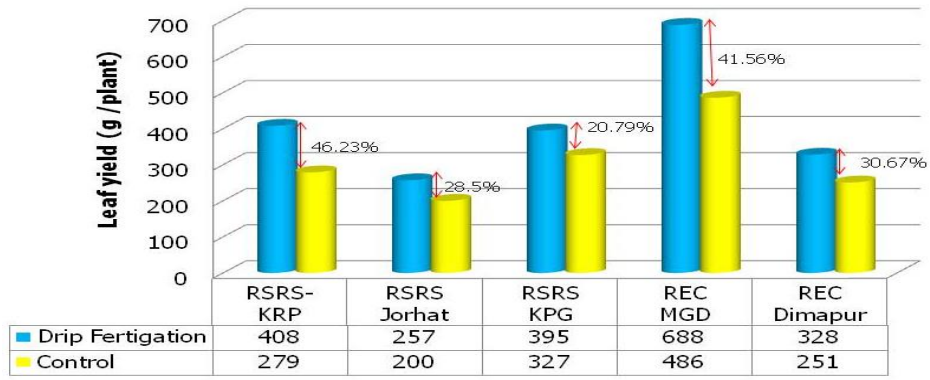
Progress:

Low cost drip fertigation system(s) for efficient utilization of water & nutrient in mulberry was validated at different locations for mulberry cultivations in E & NE states. Existed plantation of S1635 variety & 3'×3' spacing maintained with low trunk was used at all the test centres except RSRS Kalimpong where $BC_2$59 variety with medium trunk was used for evaluate drip fertigation system. The growth and yield related traits were recorded under drum kit (DKF) & drip tape fertigation (DTF) systems for five seasons. Low cost drip tape & drum kit fertigation system recorded 28% (47.57 t/ha) & 15.86% (43.05 t/ha) higher leaf yield over control (37.16 t/ha) respectively, at CSRTI-Berhampore. The seasonal pooled mean (3-4 crops) of leaf yield was recorded at five locations of E & NE regions and observed that 20.79 to 46.23 % higher leaf yield under drum kit fertigation compare to control. The higher mean performance of growth & yield related traits along with lesser incidence of pests & diseases under drip fertigation system was recorded compared to control.

Performance of growth & leaf yield under drip fertigation systems (CSR&TI-BHP)

	FLW	LMC	SLA	CCI	NPS	LLS	TSL	LMS	LFH	LY/ha	% Gain
DTF	3.98	78.44	268	21.67	15.23	123	1500	21.94	17.87	47.57	28.03
DKF	3.54	77.44	261	21.78	14.56	119	1444	21.85	17.64	43.05	15.86
Control	3.27	77.13	241	19.54	14.21	116	1429	20.49	18.34	37.16	
CD @5%	*0.89*	*1.71*	*34.7*	*3.14*	*1.29*	*8.45*	*92.5*	*2.02*	*0.88*	*12.97*	

DTF: Drip tape fertigation; DKF: drum kit fertigation; FLW: Fresh leaf weight (g); NPS: No. of primary shoots/plant; LLS: Length of longest shoot (cm); TSL: Total Shoot length/plant (cm); LMS: No. of leaves/meter length of shoot; LFH: Leaf fall at harvest (%); LMC: Leaf Moisture Content (%); SPA: Specific Leaf Area (cm^2/g); CCI: Chlorophyll content index & LY: Leaf yield per crop (t/ha)



Leaf yield performance under drum kit fertigation at different locations of E & NE India

Component- IV. Validation of seri-Win for efficacy in disease management & cocoon productivity and popularize at farmers level in East and NE region.

Objective:

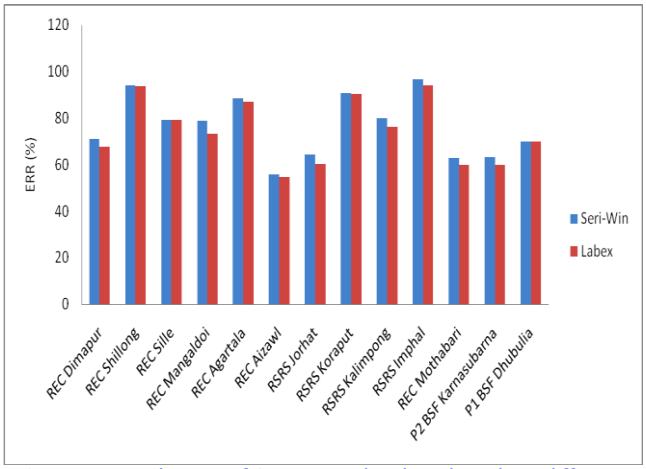
- To validate seri-Win for efficacy in disease management & cocoon productivity and popularize at farmers level in East and NE region.

Progress:

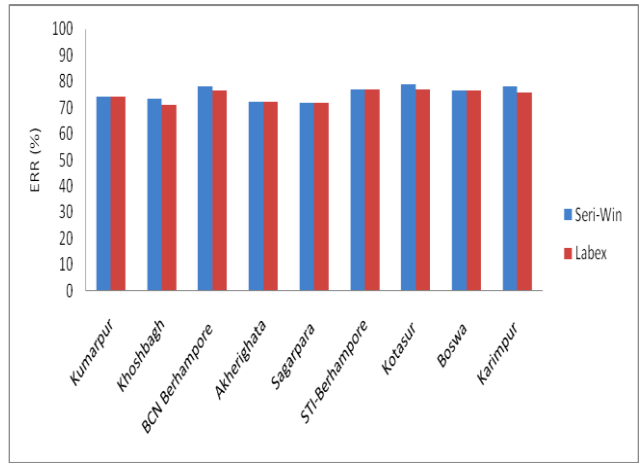
Several bed disinfectants have been developed by CSR&TI, Behampore and elsewhere over a period of time. Each one has their own advantages & disadvantages. The major disadvantage with the existing group of bed disinfectant formulations is being non- friendly to the environment and users that propelled us towards development of eco-and-user friendly bed disinfectant "Seri- Win" for disinfection of silkworm body and rearing seat.

Seri-Win is a broad spectrum, non-corrosive, eco-and-user friendly, cost-effective rearing bed disinfectant which is non-toxic to silkworms. In the year of report, on station trials (OST) were conducted for validation of the efficacy of "Seri-Win" across 23 locations of Eastern and North-Eastern states at different units of CSB and DoS farms. The average ERR for bivoltine breeds in Seri-Win treated batches was recorded as 77.05%. For Labex control, the ERR was 74.62% across two crops (Autumn and Spring) in North-Eastern states. In West Bengal, the average ERR was recorded 75.64% in Seri-Win treated multivoltine breeds and 74.31% in batches treated with existing bed disinfectant, Labex across 5 different crops (including favourable and unfavourable seasons).

In the next two years, validation of the efficacy of Seri-Win will be conducted through on farm trials (OFT) at farmer's level.



On station evaluation of Seri-Win in bivoltine breeds at different CSB units across E & NE India



On station evaluation of Seri-Win in multivoltine breeds at different DoS units of West Bengal

Continuous/Other Activities

a. Mulberry germplasm conservation and supply

Suresh, K., Yallappa Harijan and Deepika, K.U.

Germplasm provides the raw material for the breeder to develop varieties suitable for different agro-climatic conditions. Thus, conservation of core germplasm consisting of germplasm accessions, Elite clones/ Breeding lines and tetraploids are maintained in the field gene bank at this institute. Around 354 mulberry resources of twelve species are maintained as high trunk plantaion for utilization in different breeding programme. The plants were pruned during June & September and recommended cultural practices were followed for maintenance of healthy plantation.

Mulberry Genetic Resources maintained at Institute

Species/material	Sum	Indigenous	Exotic
M. indica Lin.	88	83	5
M. alba Lin.	71	32	39
M. latifolia Poir.	31	3	28
M. bombycis	14	-	14
M. multicaulis	2	-	2
Wild species	13	6	7
Elite clones	101	-	-
Tetraploids	34	-	-
Total	354	124	95

b. Mulberry varieties stock maintainance and planting material supply

Suresh, K., Deepika, K.U. and Yallappa Harijan

The mulberry varieties developed by the institute and authorized by MVAC of Central silkbaord for commercial cultivation in Eastern & NE Zone are maintained at the institute. The Institute (Breeders) stock of authorized varieties serves as initial source for three chain of systematic mulplication at RSRS (Foundation) and RECs or Kissan nursery (Certified stock). The Breeder stock plantation of varieties C-2038 (1acre), Tr-23 (0.25 acre), C-2028 (0.50 acre) & C-776 (0.10 acre) are maintained with recommended agronomic practices. Around 22 quintals of C-2038 &S-1635 and 5 kg of C776 cuttings were supplied to farmers Murshidabad Kissan nursery for rasing saplings. The saplings of C2038 (35,000), Tr-23(2000) and C-766(1000) were generated from the said stock for distribution of saplings to famers under TOT-OFT programme.

c. Establishment of co-nodal DUS testing centre at CSRTI Berhampore

Yallappa Harijan and Suresh, K.

Progress:

DUS testing is a way of determining whether a newly bred variety differs from existing varieties within the same species. The Govt. of India opted for sui generis system of protection of plant varieties and enacted 'Protection of Plant Varieties and Farmers' Right Act in 2001 to provide protection to breeders' varieties to encourage research, variety development, ensures breeders and farmers rights and growth of seed industry. It is an intellectual property rights designed to safeguard substantial economic investment involved in modern plant breeding. To claim this right the variety has to be distinct, uniform and stable (DUS) and novel. To protect two recently developed mulberry varieties C2038 & Tr-23, Co-Nodal DUS testing centre has been established at CSR&TI Berhampore. The DUS testing plantation consisting of 8 reference varieties, 27 example varieties and 2 candidate varieties was established as per the guidelines given by Protection of Plant Varieties and Farmers' Rights Authority (PPV & FRA), Government of India, New Delhi. The plantation was maintained with recommended cultural practices for recording characteristics of candidate and reference varieties.

BIOTECHNOLOGY

Concluded project

AIC02004CN: Molecular characterization and assessment of the efficacy of low molecular weight peptides isolated from mulberry leaf against flacherie disease of silkworm *[in collaboration with UNB, Siliguri].*

[May, 2019 to August, 2022]

Pooja Makwana (PI), Soumen Chattopadhyay (till July, 2021), K. Rahul, A. R. Pradeep (since August, 2021) (CIs), Suravi Ghosh, JRF, Biotechnology Division, CSR&TI, Berhampore.

Dr. Palash Mandal* (PI), Department of Botany, University of North Bengal, Siliguri, West Bengal. (*deceased in May 2022).

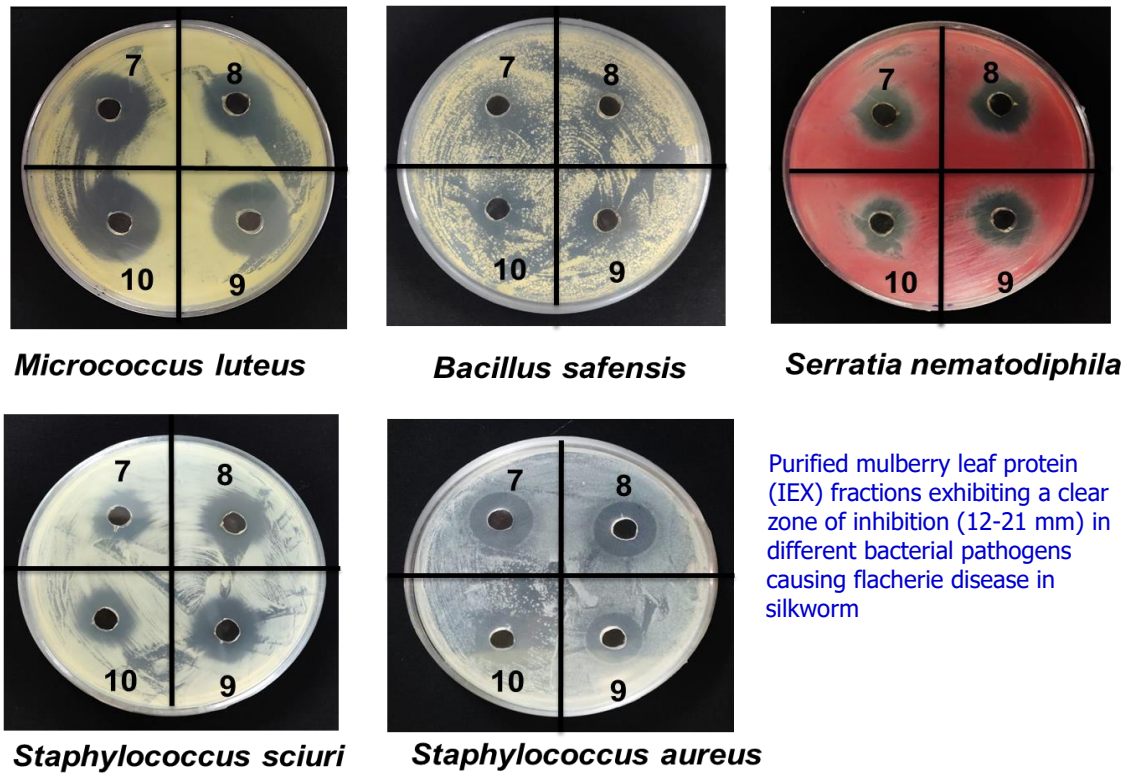
Objectives:

- Purification and characterization of identified potential peptide(s) using HPLC – MS based approach
- Assessment of protection potential of identified low molecular weight peptide fractions against pathogen(s) of flacherie
- Validation of disease suppression ability and silkworm quality parameters by the synthesized specific peptide

The plants produce low molecular weight (LMW) peptides (3-10kDa) of <50 amino acids that are cationic in nature, rich in cysteine or glycine residues and has a broad-spectrum activity against various fungi, virus and bacteria. AMPs are an essential element of plant innate immunity, especially to biotic stress factors. The study aimed to identify LMW bioactive peptides from mulberry leaves with antibacterial activity against bacterial pathogens causing flacherie disease in the mulberry silkworm, *Bombyx mori*.

The low molecular weight AMPs were purified from mulberry (S1635) leaves by homogenisation of leaves in extraction buffer (pH 7.2; 1:5 w/v). The aqueous leaves extract was precipitated by ammonium sulphate (40%) followed by desalting through Sephadex G-50. Further, G-50 elute was subjected to gel filtration chromatography through Sephadex G-25 column to obtain low molecular weight proteins. The semi-purified mulberry leaves protein retrieved after gel-filtration chromatography was further purified by Ion-exchange chromatography (IEX). The elutes were passed through the strong cation exchanger (SP Sepharose) at a flow rate of 1ml/min. The absorbance was read at 280nm and the chromatogram was plotted. Major peaks in the chromatogram were collected and tested for antibacterial activity against bacterial pathogens causing flacherie disease in silkworm.

Bacterial pathogens namely *Staphylococcus aureus*, *Bacillus thuringiensis*, *Bacillus flexus*, *Micrococcus luteus, Bacillus safensis* causing flacherie disease in mulberry silkworms maintained at Silkworm Pathology section of this institute were utilised for assessing the antibacterial activity of mulberry leaf protein. In addition, four bacteria *Staphylococcus sciuri*, *Micrococcus terreus*, *Enterobactor hormaechi* and *Serratia nematodiphila* were isolated from flacherie- infected silkworms and identified by 16s rRNA gene sequencing. Pathogen challenge study was performed in *Bombyx mori* larvae by inoculating silkworm larvae with each pathogen and the mortality (%) was recorded. The antibacterial activity of the aqueous extract, semi-purified and LMW peptide fractions were determined by well diffusion assay against the different bacterial species. A clear zone of inhibition developed in plates indicated antibacterial activity of the mulberry leaf protein fractions. The minimum inhibitory concentration of aqueous extract, semi-purified and purified extracts was determined and the results indicated that the antibacterial activity increased with purification of mulberry leaves protein.



Purified mulberry leaf protein (IEX) fractions exhibiting a clear zone of inhibition (12-21 mm) in different bacterial pathogens causing flacherie disease in silkworm

The purified mulberry leaves protein was then analysed by LC-MS/MS (C-CAMP, Bangalore) which revealed the presence of peptides such as non-specific Lipid transfer protein 1 (LTP), pathogenesis-related protein 1 (PR1), Germin-like protein (GLP) and Osmotin-like protein (OLP). In addition, the antioxidant potential of protein extract was also assessed by DPPH, Metal Chelating, Nitric oxide, Superoxide and ABTS free radical scavenging assays. The free radical scavenging activity was reduced with purification of

Mortality (%) in *B. mori* on challenging with different bacterial pathogens

#	Pathogens	Mortality (%)
1	*Micrococcus luteus*	27
2	*Micrococcus terreus*	25
3	*Staphylococcus aureus*	63
4	*Bacillus safensis*	30
5	*Bacillus subtilis*	21
6	*Bacillus flexus*	15
7	*Staphylococcus vitulinus*	45
8	*Enterobacter hormaechei*	10
9	*Serratia nematodiphila*	45
10	*Staphylococcus sciuri*	55
11	*Bacillus thuringiensis*	50

MIC of aqueous extract, semi-purified and purified protein extracts against bacterial pathogens causing flacherie disease in silkworm

S-1635	Protein purification steps	Antibacterial activity against bacterial pathogens
Crude	Buffer extract	200 – 500 µg/ml
	$(NH_4)_2SO_4$ ppt	200 – 500 µg/ml
Gel filtration Chromatography	Sephadex G50	100 – 200 µg/ml
	Sephadex G25	<100 µg/ml
Ion-Exchange chromatography	SP sepharose	1.5 – 50 µg/ml

mulberry leaves protein. In order to validate the disease suppression ability of identified LMW peptides, AMP region in the peptides were predicted through online AMP prediction tools. The peptide region with probability >0.9 were selected for further analysis. The protein sequences of aforementioned proteins/peptides reported from other plants were retrieved from PlantAMP databases and multiple sequence alignment was performed. Further, peptide logo analysis was performed to check the residue preference. Based on analysis performed, four AMPs Pep1, Pep2, Pep3 and Pep4 were designed from PR1, OLP, LTP and GLP, respectively. These four peptides were synthesized and efficacy of these designed AMPs was determined against flacherie causing bacterial pathogens in vitro and by bioassay. The microdilution well method was used to assess the antibacterial activity of Pep1, Pep2, Pep3 and Pep4 against bacterial pathogens. Pep1 and Pep2 exhibited 55-98% growth inhibition against *Bacillus* spp., *Staphylococcus* spp. and *Micrococcus* spp. MIC of Pep1 and Pep2 ranged from 10-50µM against *Bacillus* spp., *Staphylococcus* spp. and *Micrococcus* spp.

Synthetic peptides exhibiting antibacterial activity against *Staphylococcus* spp., *Bacillus* spp. and *Micrococcus* spp. at 50 µM

Peptide	Growth Inhibition (%)		
	Staphylococcus sp.	*Bacillus* spp.	*Micrococcus* spp.
Pep1	55	98	75
Pep2	20	77	91
Pep3	10	14	20
Pep4	33	8	34

Conclusion:

Antimicrobial peptides have been identified from mulberry leaf. From the AMPs, short length AMPs (PR1 and OLP) are designed that could be used to inhibit bacterial growth thereby preventing the occurrence of bacterial flacherie in the silkworm, *Bombyx mori*.

Ongoing projects

AIT02012CI: Characterization of mulberry silkworm, Bombyx mori L. mutants for tolerance to flacherie syndrome through genome editing tools [DST-JSPS-CSB funding in collaboration with Japan].

[October, 2021 to September, 2023]

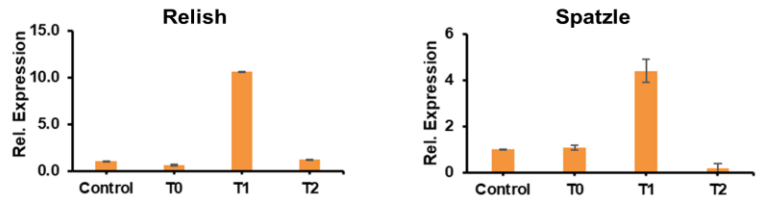
Sivaprasad, V. (PI; upto 31st May, 2023), Pooja Makwana (PI) and K. Rahul (CIs), Swagata Sarkar / Nilufar Yasmin JRF, Biotechnology Division, CSRTI-Berhampore.

Japanese collaborators: Katsuhiko Ito (PI), Tokyo University of Agriculture & Technology, Tokyo and Jun Kobayashi, Yamaguchi University, Yamaguchi (CI).

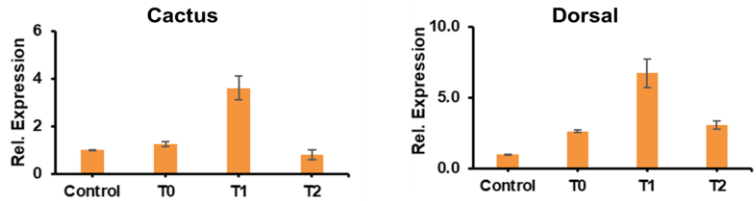
Objectives:

- To develop silkworm site-directed mutants exhibiting tolerance to flacherie syndrome by genome editing.
- To evaluate developed mutants for cocoon crop improvement in Eastern & North Eastern India and Japan.

Flacherie, a silkworm disease, caused by bacteria BmDNV1, BmDNV2, BmIFV which belongs to the genera *Streptococcus*, *Staphylococcus,* or a mixed infection. The present study aims to develop silkworm mutants tolerant to flacherie syndrome utilizing CRISPR/Cas genome editing tool. Based on pathogen challenge studies, two breeds Nistari and SK7 are selected for genome editing to develop the mutant tolerant to flacherie. On exchange program, the Japanese collaborator, Dr. Katsuhiko Ito, Associate Professor has visited CSR&TI, Berhampore and discussed the work plan and details on guide RNA synthesis. During the exchange visits to Japan Indian investigators are trained on genome editing and microinjection techniques in silkworm. In order to screen the target gene for genome editing, gene expression studies were conducted in tissues (fatbody and midgut) collected from Nistari inoculated with *Staphylococcus aureus* and control. The relative expression of immune genes *Relish1*, *Spatzle*, *Cactus* and *Dorsal* were higher on day 1 after infection in fatbody while in midgut relative expression of *Relish*, *Spatzle* and *Dorsal* was lower after infection except for *Cactus*. The BmBDV resistance *nsd-2* marker tested in Nistari and SK7 indicated the absence of resistance to BmBDV in the two breeds. The primers are designed for the target gene *nsd-2* for conducting genome editing experiments.



Relative expression of genes in fatbody collected from control and *S. aureus* infected Nistari larvae on day zero (T0), day one (T1) and day 2 (T2) after inoculation**.**



Relative expression of genes in midgut collected from control and S. aureus infected Nistari larvae on day zero (T0), day one (T1) and day 2 (T2) after inoculation

AIT02008SI: Identification of high humidity tolerant silkworm breeds/ hybrids for Eastern & North Eastern India.

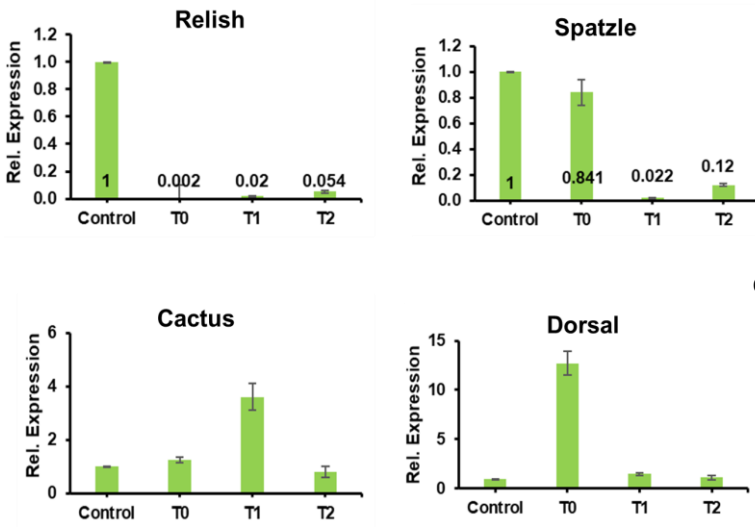
[June, 2020 to May, 2024]

Raviraj V.S. (PI), Pooja Makwana and A.R. Pradeep and Harish Babu, S.

Objective:

- To identify markers for tolerance to high temperature and high humidity in silkworm.

Bivoltine breeds are significant source of silk production in the sericulture industry. Lack of bivoltine breeds suitable for eastern and NE region and extreme climatic conditions of high temperature coupled with high humidity resulted in low production and productivity of silk in the eastern and northeastern regions. The popular bivoltine hybrids, i.e. (SK6 x SK7 and BCon1 x BCon4), have been reared only in favorable seasons. In an attempt to introduce all season bivoltine breeds, present investigation is taken up to identify the bivoltine breeds tolerant to high temperature and humidity and gene markers through gene expression/SNP validation studies. Genes encoding Transient receptor proteins (TRP), *pyrexia & painless*) and circadian rhythm genes (*Period and timeless*) have been selected for the study based on preliminary reports of CSRTI-Mysore and other recent studies. These biotechnological tools coupled with conventional breeding by directional selection for improved productivity, have assisted in identifying breeds tolerant to high temperature and humidity.



Markers for high humidity stress

Through Sanger sequencing of the *Pyrexia* gene amplicon, two potential single nucleotide polymorphism (SNP) markers associated with high humidity tolerance (Pyx3 & Pyx4) are identified. SNP markers are validated in different populations of bivoltine breeds that have survived under simulated conditions (36^{o}C temperature and 85 ± 5 % RH) of high humidity and high temperature. Primers of these sequences are utilized to screen populations/broods with tolerance to high humidity.

Markers for high temperature tolerance

Two SSR markers S0803 & S0816 are used to identify thermo tolerant bivoltine breeds. The bivoltine breeds which showed survival above 50% under the simulated conditions and having the presence of markers were considered for the study.

Identification of high humidity and high temperature tolerance breeds

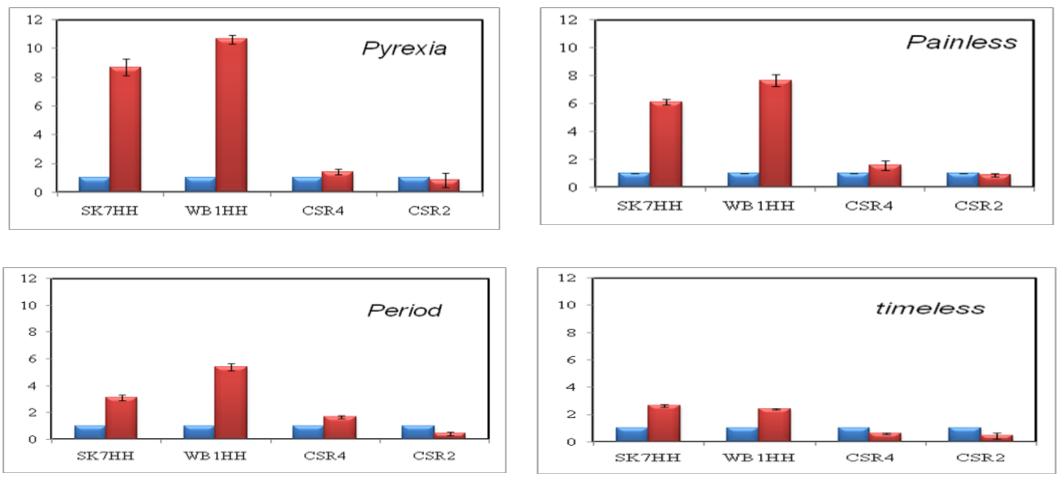
Five bivoltine breeds have been identified to be tolerant to high temperature and high humidity which are SK7HH, B.Con4HH, N5HH, HTH10HH and WB1HH. This was done through phenotypic survival study under simulated conditions and later on the basis of presence of SNP/ SSR markers. These breeds showed tolerance to simulated high temperature and high humidity (36°C and 85% RH) conditions in environmental chamber and in unfavorable seasons (33°C-35°C and 75-90% RH) of West Bengal. These identified breeds showed an average pupation rate of 56- 66%.

Performance of Bivoltine Silkworm Breeds with Tolerance to High Humidity (85±5%) & High Temperature (35±5˚C)

Breed	Season	Pupation (%)	Mean Cocoon Wt. (g)	Mean Shell Wt.(g)	Mean Shell Ratio(%)	MAS	
						HH	HT
SK7HH	Jun-July 2022	61	1.160	0.194	16.72		✓
	Oct-Nov 2022	71	1.590	0.283	17.77		✓
	Jan-Feb 2023	77	1.525	0.285	18.69		✓
B.Con4HH	Jun-July 2022	58	0.980	0.170	17.32	✓	✓
	Oct-Nov 2022	69	1.379	0.245	17.78	✓	✓
	Jan-Feb 2023	71	1.527	0.255	16.70	✓	✓
HTH10HH	Jun-July 2022	54	0.926	0.164	17.72	✓	✓
	Oct-Nov 2022	67	1.326	0.219	16.56	✓	✓
	Jan-Feb 2023	68	1.490	0.277	18.59	✓	✓
N5HH	Jun-July 2022	55	0.960	0.173	17.96	✓	✓
	Oct-Nov 2022	60	1.250	0.229	18.32	✓	✓
	Jan-Feb 2023	65	1.649	0.324	19.62	✓	✓
WB1HH	Jun-July 2022	63	1.248	0.198	15.83	✓	✓
	Oct-Nov 2022	71	1.397	0.249	17.86	✓	✓
	Jan-Feb 2023	69	1.563	0.310	19.83	✓	✓

Transient receptor proteins (TRP) and circadian rhythm gene expression in high humidity tolerant breeds

The "thermoTRP" channel genes *Painless* and *Pyrexia* are known to be activated in *Drosophila melanogaster* (Sokabe et al., 2009, The Journal of Neurosciences, 28, 9929-38) by temperatures higher than the optimal temperature (18–24°C). The TRP channel genes and circadian rhythm genes were analyzed for gene expression in the brain of bivoltine silkworm *Bombyx mori*. *B. mori* is domesticated to live at an ambient temperature of 25±2 ºC but often encounters hot temperature in the summer season of India throughout the country. Four genes were selected for the study, namely *pyrexia, painless, period, and timeless*, and were subjected to expression analysis. The analysis revealed up-regulation of these genes, predominantly in the two breeds, WB1HH and SK7HH. These bivoltine breeds were thermo-tolerant and showed an average of 70% pupation and survival under the simulated conditions. The breeds CSR2 and CSR4 are stress susceptible breeds and it showed less expression of *pyrexia, painless, period, and timeless* genes after exposing to abiotic stress conditions.



Fold change in expression of "thermoTRP" channel genes and circadian gene in larval brain of tolerant and susceptible breeds exposed to high temperature and high humidity (red columns) (36ºC temperature and 85 ± 5 % RH) and control (ambient; blue columns) conditions

AIB02019MI: Development of bivoltine double hybrids suitable for different regions of India (Collaboration with: CSRTI-Mysuru, CSRTI-Pampore, RSRS-Jammu & RSRS-Manipur).

[June, 2022 to May, 2025]

Raviraj V.S. (PI); Yendrembam Surjalata Devi (PA) (CSRTI-Berhampore)

Kusuma L., (Co-PI); Harshitha (PA) (CSRTI-Mysore)

Kiran R., (Co-PI); Nadiya Ashraf (PA) (CSRTI-Pampore)

L. Soumen Singh (RSRS Imphal)

Rita Singh (RSRS Jammu)

Objective:

- Development of bivoltine breeds with high temperature & humidity tolerance through Marker assisted selection.

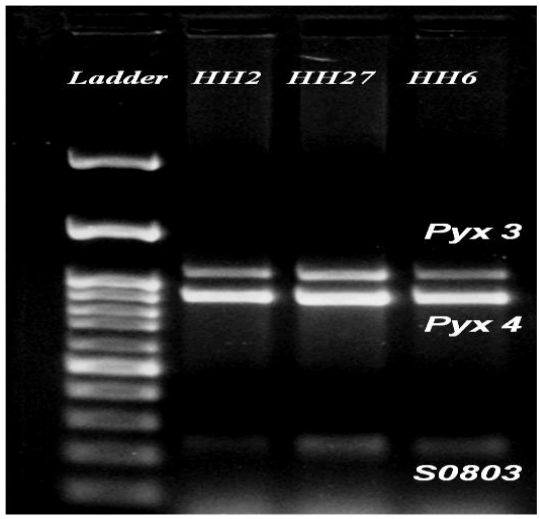
Bivoltine silk production across India has not picked up at many mulberry silkworm-dedicated eastern and NE states compared to Southern states, as suitable bivoltine hybrids are unavailable and seed crop failure at commercial level. The major limitations of bivoltine silk production are limited number of rearing schedules of bivoltine foundation crosses in major mulberry growing states, adverse climatic conditions (high temperature & high humidity) and associated low economic traits. Silkworms are usually susceptible to high humidity and temperature fluctuations, which further hamper larval growth and development. High humidity and high temperature prevail in the adverse seasons of Eastern and North Eastern states. Lower survival in the commercially exploited silkworm hybrids is the primary limiting factor for bivoltine popularization. Along with bivoltine breeds/hybrids suitable for favorable conditions, a few bivoltine breeds are also identified for high-temperature tolerance and high humidity. Generally, young-age silkworms essentially require highly humid conditions (>90% RH), while late-age silkworms need a relative humidity of 60-70% (50-60% at the time of spinning) for optimal growth and silk production. Breeds and hybrids that can tolerate different temperatures are developed using molecular markers known as SSRs. Recently, CSRTI-Berhampore has developed a few bivoltine lines that are tolerant to high humidity using marker-assisted selection based on *pyrexia gene* (PYX3 & PYX4). Molecular approaches, including marker-assisted selection for high humidity, have helped to identify tolerant silkworm breeds in response to high humidity. This project aims to enhance the genetic makeup of the FC1 and FC2 parental breeds by combining traditional breeding practices with molecular biology techniques. The focus is on the introgression of high temperature and humidity tolerance markers. The investigators propose to utilize silkworm breeds identified for high productivity and temperature-humidity tolerance in developing an improved hybrid line replacing the parental combinations with improved economic traits. The experiments would be conducted in all the seasons (unfavorable & favorable) in CSRTI Berhampore, CSRTI-Mysore, and CSRTI-Pampore. This study aims to develop hybrids that can thrive in hot and humid conditions with improved economic traits for commercial use in India.

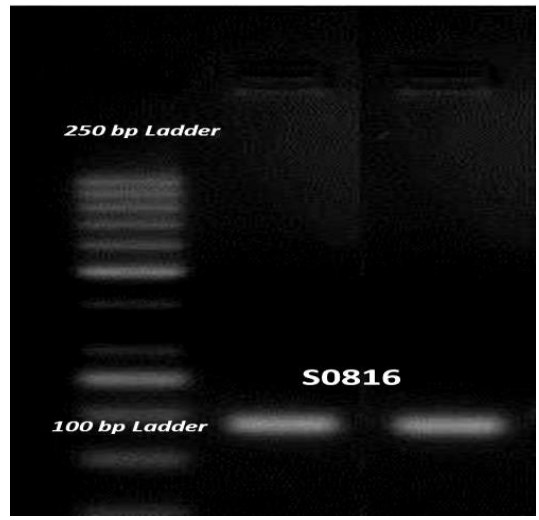
Breeding lines

Ten new lines are developed by crossing potential high temperature and humidity tolerant females (identified from the project AIT02008SI) with high yielding FC1 & FC2 males. The maternal parents used are WB1HH, SK7HH, HTH10HH, SK7HH, and B.Con4HH. Ten new lines viz., HH2, HH2A, HH2B, HH27, HH27A-oval line, HH27B, HH6, HH6A, HH26, and HH26A-dumbbell line are developed. Presently, the breeding lines are in F3 generation.

Marker assisted selection:

PCR-based multiplexing assays are utilized to test SNP markers (Pyx-3 & Pyx4) for high humidity tolerance and an SSR marker S0803, for high temperature tolerance in single reaction.





Experimental rearing:

Experimental rearing is carried out in both favorable and unfavorable seasons, and stabilization of newly developing breeds is in progress based on their survival (>80% in all the lines) and economic parameters like SCW (~1.57±0.05 g). The experimental rearings are conducted in multi-locations to assess the performance in different climatic conditions. The following experimental data represents the rearing performance of CSRTI- Berhampore.

Rearing performance of newly breed lines developed from the cross of high temperature / humidity tolerance breed females with FC1/FC2 males at Berhampore

Breeds	Fecundity (Mean±SE)	ERR (Kg) (Mean±SE)	SCW (g) (Mean±SE)	SSW (g) (Mean±SE)	SR (%) (Mean±SE)
HH2	596±01.90	13.05±00.26	1.51±00.01	0.38±0.01	21.83±00.78
HH2A	577±03.07	12.26±00.18	1.51±00.02	0.34±0.01	21.89±00.72
HH2B	566±03.11	13.25±00.47	1.54±00.02	0.31±0.01	20.43±00.66
HH27	606±04.88	12.24±00.51	1.55±00.03	0.30±0.01	19.71±00.20
HH27A	561±05.23	12.47±00.13	1.67±00.03	0.31±0.01	19.60±00.03
HH27B	603±11.19	13.66±00.33	1.72±00.01	0.35±0.00	20.47±00.25
HH6	584±03.01	12.01±00.43	1.68±00.05	0.33±0.01	20.19±00.23
HH6A	590±02.73	11.25±00.20	1.37±00.04	0.29±0.01	21.34±00.13
HH26	583±05.03	13.43±00.52	1.66±00.04	0.31±0.01	18.92±00.14
HH26A	544±14.49	12.27±00.31	1.46±00.02	0.31±0.00	21.17±00.49

SILKWORM BREEDING AND GENETICS

Concluded Project

AIB 02009MI: Authorization trials of silkworm hybrid, 12Y x BFC1 in Eastern and North-Eastern India.

[August, 2020 to July, 2022]

CSRTI-Berhampore: N. Chandrakanth (PI); A.K. Verma (upto Dec., 2020) & T. Ranjita Devi; SSPC-Berhampore: S.N. Bagchi; CSTRI-Bengaluru: A. Reddy.

Objective:

- To evaluate the newly developed Multi × Bi hybrid, 12Y × BFC1 for generating data for hybrid authorization with the farmers in Eastern & North Eastern India.

A new improved cross breed (ICB), 12Y × BFC1 for high shell content was developed at CSRTI-Berhampore. In on farm trials, the ICB performed better over the existing hybrid, N × (SK6 × SK7). It becomes imperative to evaluate the performances of 12Y × BFC1 in different states of E and NE India for assessing the suitability across the seasons and regions. The successful large scale field testing through authorization trials ensures the suitability of 12Y × BFC1 for commercialization. A total of 2.29 lakh dfls of 12Y × BFC1 were field tested in two years across the seasons covering the seven states of E & NE India. An overall improvement in the economically important rearing and reeling traits along with egg recovery (g/kg) was observed over the existing crossbreed.

Hybrid production and field testing:

The parental breeds, 12Y and BFC1 were maintained conforming to their original characters by cellular rearings in triplicates at CSRTI-Berhampore. Stringent selection was performed in cocoon stage to restrict the parental breeds to their original characters. Mass rearings were also conducted for multiplication of 12Y and BFC1 at CSRTI-Berhampore. After 3rd moult, larvae with optimum growth were retained. After cocoon formation, good cocoons with the original shape with that of the parents were selected for producing P1 dfls. The P1 dfls were supplied to the adapted seed rearers (ASRs) through NSSO-SSPC units for conducting P1 rearings. Thus, the seed cocoons produced were utilized for preparing hybrid dfls (12Y × BFC1). The production of hybrid dfls of 12Y × BFC1 was entirely carried out at NSSO-SSPC units. The data on economically important grainage parameters like pairing percentage (%), dfl recovery (%) and egg recovery (g/kg) were collected. The 12Y × BFC1 dfls along with the disinfectants were supplied to the farmers at free of cost. Since, N × (SK6 × SK7) is the ruling cross breed, the data on the performance of N × (SK6 × SK7) was recorded as control.

Data collection and statistical analysis:

Farmer-wise data on rearing traits like cocoon yield, cocoon weight, shell weight and percentage along with cocoon selling rate were collected. The data was compiled for statistical analysis. Two-way ANOVA was performed on the rearing traits keeping silkworm hybrids and locations (States) as fixed factors. For reeling parameters, 3kg of green cocoons per farmer was collected as one sample, which was dried and sent to CSTRI-Bangalore for assessing silk reeling and grading.

Results:

Rearing performance:

A total of 2.29 lakh dfls of 12Y × BFC1 were tested against 1.77 lakh dfls of N×(SK6×SK7) covering 7 states of E and NE India. Rearing data on cocoon yield, single cocoon weight (SCW), single

State-wise rearing performance of 12Y × BFC1

State (Location)	Farmer (No.)	Crop (No.)	No. of dfls	Yield/ 100 dfls (kg)	SCW (g)	SSW (g)	Shell (%)
West Bengal	1679	6	165400	50.26	1.631	0.286	17.46
Tripura	1115	6	58500	42.72	1.513	0.275	18.03
Nagaland	20	2	1100	40.15	1.359	0.243	17.72
Assam	28	3	1300	40.19	1.319	0.218	16.60
Odisha	8	2	800	41.88	1.456	0.217	14.96
Ar. Pradesh	9	2	750	57.11	1.531	0.262	17.24
Jharkhand	38	3	1550	44.87	1.352	0.227	16.80
Average/Total	**2897**	**24**	**229400**	**45.31**	**1.449**	**0.248**	**17.05**
Control [N × (SK6 × SK7)	2273	24	177600	40.28	1.371	0.225	16.48
			IOC (%)	**12.49**	**5.69**	**10.22**	**3.46**

shell weight (SSW) and shell % was collected for the 24 crops tested. An average cocoon yield of 45.31 kg was recorded with 12Y × BFC1 against control of 40.28 kg with an improvement of 12.49%. Highest cocoon yield of 57.11 kg for 12Y × BFC1 was recorded in Arunachal Pradesh followed by 50.26 kg in West Bengal and 44.87 kg in Jharkhand. Highest cocoon weight (1.631 g) and shell weight (0.286 g) were recorded in West Bengal while the highest shell percent (18.03%) was recorded in Tripura. The overall average of cocoon weight (1.449 g), shell weight (0.248 g) and shell percent (17.05%) have resulted in the improvement of 5.69%, 10.22% and 3.46% respectively over control. The performance of 12Y × BFC1 in each state is presented below.

Rearing performance of 12Y × BFC1 in West Bengal

Hybrid	Crop	Dfls	Farmer (no)	Yield/ 100 dfls	SCW (g)	SSW (g)	SR (%)	Rate (Rs.)	Avg.amount/ 100 dfls(Rs.)
12Y × BFC1	06	165400	1679	50.26	1.631	0.286	17.46	505	25487
N × (SK6 × SK7)		120000	1555	46.48	1.477	0.244	16.54	450	20250
Improvement over control (%)			**-**	**8.13**	**10.41**	**17.21**	**5.59**	**55**	**5131**

Rearing performance of 12Y × BFC1 in Tripura

12Y × BFC1	06	58500	1115	42.72	1.513	0.275	18.03	280	11960
Control		55000	1100	38.33	1.395	0.252	18.02	280	10732
Improvement over control (%)		**-**	**-**	**11.45**	**8.46**	**9.13**	**0.06**	**0**	**1228**

Rearing performance of 12Y × BFC1 in Nagaland

12Y × BFC1	2	1100	20	40.15	1.359	0.243	17.72	300	12045
N × (SK6 × SK7)		1000	20	35.03	1.319	0.211	16.10	280	9808
Improvement over control (%)		**-**	**-**	**14.62**	**3.03**	**14.69**	**10.12**	**20**	**2237**

Rearing performance of 12Y × BFC1 in Assam

12Y × BFC1	3	1300	28	40.19	1.319	0.218	16.6	Self reeling by farmers	
N × (SK6 × SK7)		1000	20	38.23	1.221	0.209	17.12		
Improvement over control (%)		**-**	**-**	**5.13**	**8.03**	**14.69**	**-3.04**	**-**	**-**

Rearing performance of 12Y × BFC1 in Odisha

12Y × BFC1	2	800	8	41.88	1.456	0.217	14.96	210	8795
N × (SK6 × 7)		600	8	38.32	1.443	0.211	14.62	200	7665
Improvement over control (%)		**-**	**-**	**9.29**	**0.90**	**2.84**	**2.33**	**10**	**1130**

Rearing performance of 12Y × BFC1 in other NE states

Ar. Pradesh	2	800	9	57.11	1.531	0.262	17.24	300	17100
Jharkhand	3	1550	38	44.87	1.352	0.227	16.80	205	9225
Average		**-**	**-**	**50.99**	**1.44**	**0.245**	**17.02**	**252**	**13162**

Results of two-way ANOVA on rearing traits

Rearing trait	Factor	DF	Mean square	*P*
Cocoon yield / 100 dfls	State	6	407.5	0.0001
	Hybrid	1	809.5	0.0001
	State × Hybrid	6	28.6	0.0001
Single cocoon weight	State	6	0.127	0.0001
	Hybrid	1	0.076	0.076
	State × Hybrid	6	0.132	0.0001
Single shell weight	State	6	0.006	0.001
	Hybrid	1	0.003	0.01
	State × Hybrid	6	0.014	0.001

The results of two-way ANOVA performed on the rearing traits with silkworm hybrids and locations (States) as fixed factors revealed that there was no significant difference between single cocoon weight of 12Y × BFC1 and control but the single shell weight and cocoon yield/100 dfls varied significantly among the hybrids, locations (states) and their interactions.

Reeling performance

State-wise reeling performance of 12Y × BFC1

State	Hybrid	No.	Crop	FL (m)	NBFL	Denier (d)	Reel-Ability (%)	Ren-ditta (kg)	Raw silk (%)	Neat-ness
West Bengal*	12Y × BFC1	35	3	583	484	2.82	83	9.52	10.72	94
	Control	20		542	439	2.62	79.9	10.2	9.89	91
Tripura*	12Y × BFC1	15	3	631	428	2.77	68.2	9.4	12.1	93
	Control	5		500	297	2.60	59.9	10.2	15.4	87
Nagaland	12Y × BFC1	1	1	634	634	2.64	58	10.99	9.10	90
	Control	1		511	511	2.45	56	12.01	8.33	83
Assam	12Y × BFC1	Self reeling by the farmers								
Odisha	12Y × BFC1	1	1	546	274	2.53	62	9.21	10.8	80
Ar. Pradesh	12Y × BFC1	1	1	456	229	2.36	56	7.55	24.4	81
Jharkhand	12Y × BFC1	2	2	590	501	2.90	60	9.91	12.4	84
12Y × BFC1				573	425	2.67	65	9.4	13.3	88
Control [N × (SK6 × SK7)]				518	416	2.55	65	10.8	11.2	87
Improvement over control (%)				10.62	2.16	4.71	0.00	-12.96	18.75	1.15

**Reeling performance represents the data for three seasons*

***Cocoons for other seasons were not collected due to COVID19 Pandemic and Lockdown*

Seven parameters namely filament length, non-breakable filament length, denier, reelability, renditta, raw silk and neatness were considered for assessing the reeling performance of the silkworm hybrids. Fifty-five batches of 3 kg each of green cocoons were sent for post cocoon analysis for 12Y × BFC1 and 26 batches for the control at CSTRI, Bengaluru. The overall results of reeling analysis showed that the 12Y × BFC1 hybrid is superior to the control in many of the parameter's studies. In comparison to control, the filament length of the 12Y × BFC1 was 573 against control of 518 with an improvement of 10.62%. Similarly, the NBFL of the 12Y × BFC1 was 425 against control of 416 with an improvement of 2.16%. The denier was better in the control than that of the 12Y × BFC1. The reelability of the 12Y × BFC1 was on par with the control with 65%. The renditta of the 12Y × BFC1 was 12.96% lesser than the control. The raw silk and neatness of the 12Y × BFC1 was 13.3% and 88p against 11.2% and 87p of control with an improvement of 18.75% and 1.15%, respectively. Raw silk testing/grading of 12 x BFC1 has resulted in grading from A to 2A grade (BIS Grading) but for control it was varying from D to 2A indicating the superior quality of raw silk of 12Y × BFC1.

#	Quality characteristics of Raw silk reeled at MSR Division, CSTRI, Bengaluru																													
	Particulars		**12Y x BFCI**																				**N x (SK6 x SK7)**							
		Unit	**V**	**G**	**V**	**G**	**V**	**G**	**V**	**G**	**V**	**G**	**V**	**G**	**V**	**G**	**V**	**G**	**V**	**G**	**V**	**G**	**V**	**G**	**V**	**G**	**V**	**G**	**V**	**G**
I	Average size		22.2		23.6		22.4		22.1		19.2		23.1		24.1		23.5		21.4		21.6		22.0		23.1		22.2		21.0	
II	Major Tests																													
1.	Standard size deviation		1.47	2A	1.6	2A	1.0	4A	1.45	2A	1.95	A	1.61	2A	1.27	4A	1.59	2A	1.03	4A	1.12	4A	1.36	2A	1.57	2A	2.87	D	1.59	2A
2.	Evenness variation-I	Stripes	8	4A	10	4A	8	4A	10	4A	10	4A	6	4A	10	4A	4	4A	4	4A	8	4A	6	4A	8	4A	12	4A	10	4A
3.	Evenness variation-II	Stripes	2	4A	0	4A	0	4A	2	4A	0	4A	4	2A	0	4A	2	4A	2	4A	2	4A	0	4A	2	4A	2	4A	2	4A
4.	Cleanness	%	93	2A	94	2A	95	3A	96	3A	96	3A	95	3A	91	A	97	4A	95	3A	96	3A	96	3A	93	2A	93	2A	90	A
5.	Average neatness	%	94	4A	94	4A	91	2A	91	2A	93	3A	89	A	89	A	90	2A	97	4A	90	2A	99	4A	93	3A	94	4A	95	4A
6.	Low neatness	%	90	4A	88	3A	88	3A	85	2A	90	4A	83	2A	85	2A	85	2A	90	4A	85	2A	95	4A	90	4A	90	4A	90	4A
III	Auxillary tests																													
1.	Maximum deviation		2.1	1	2.1	1	1.6	1	2.0	1	2.7	1	2.2	1	2.0	1	2.5	1	1.4	1	1.7	1	2.1	1	2.2	1	4.1	1	2.2	1
2.	Evenness variation-III	Stripes	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
3.	Winding breaks /10skeins/hr		2	2	2	2	2	2	3	2	4	3	4	3	2	2	2	2	2	2	2	2	2	2	3	2	4	3	4	3
4.	Tenacity	gpd	3.8	1	3.9	1	3.9	1	3.8	1	3.8	1	3.7	1	3.8	1	3.8	1	4	1	3.8	1	3.8	1	3.7	1	3.8	1	3.8	1
5.	Elongation	%	21	1	22	1	23	1	22	1	22	1	22	1	23	1	22	1	22	1	22	1	22	1	21	1	22	1	21	1
6.	Cohesion	strokes	61	1	62	1	112	1	96	1	71	1	67	1	89	1	91	1	87	1	74	1	92	1	92	1	107	1	93	1
	Overall Grade			2A		2A		2A		2A		A		A		A		2A		3A		2A		2A		2A		D		A

V:Value; G: Grade

The P1 rearings were conducted in six crops, of which five were done in West Bengal and one in Andhra Pradesh at ASRs attached to NSSO-SSPC units. In West Bengal, the average cocoon yield recorded for 12Y was 26.87 kg and that of BFC1 was 36.19 kg. The highest and lowest cocoon yield for 12Y was 33.75 kg and 20.32 kg during December and May crop, respectively. Similarly, the highest and lowest cocoon yield for BFC1 was 40.47 kg and 20.81 kg during December and September crop, respectively. But, the one crop taken in the Andhra Pradesh showed a highest cocoon yield for 12Y and BFC1 with 52 kg and 60 kg, respectively.

P1 rearing performance of 12Y and BFC1 in West Bengal

Seed Crop	Breed	Dfls	Farmer (no)	Yield/ 100 dfls	SCW (g)	SSW (g)	SR (%)	Chit
Dec 20	12Y	850	08	21.93	1.114	0.143	12.87	797
	BFC1	650	03	40.47	1.48	0.28	19.32	686
Feb 21	12Y	800	06	28.44	1.161	0.171	14.77	861
	BFC1	600	03	45.80	1.50	0.30	19.96	664
May 21	12Y	500	08	20.32	1.198	0.144	12.02	780
	BFC1	200	02	35.09	1.459	0.298	20.42	695
Sep 21	12Y	200	02	29.90	1.29	0.20	15.57	820
	BFC1	100	01	20.80	1.538	0.302	19.64	650
Dec 22	12Y	2000	35	33.75	1.104	0.137	12.41	908
	BFC1	1000	06	38.82	1.51	0.29	18.87	652
Total / Avg	**12Y**	**4350**	**59**	**26.87**	**1.173**	**0.159**	**13.53**	**833**
	BFC1	**2550**	**15**	**36.19**	**1.497**	**0.294**	**19.65**	**669**
		CD @ 1%		8.60	0.17	0.07	3.32	91.58
		CV (%)		26.52	12.72	30.80	19.49	11.86
P1 rearing performance of 12Y and BFC1 in South India								
Dec 22	12Y	500	01	52	1.36	0.22	16.17	749
	BFC1	300	01	60	1.687	0.33	19.56	655

The grainage was conducted for six crops at SSPC-Berhampore in West Bengal and once at SSPC-Madanapalle in Andhra Pradesh. 12Y × BFC1 was superior in all the grainage parameters studied *vis-à-vis* the popular control crossbreed N × (SK6 × SK7). Data analysis revealed significant differences in pairing percentage, dfls recovery and egg recovery between the silkworm hybrids during October seasons indicating the better performance of 12Y and BFC1 in adverse conditions (Sept.) in comparison to control. The highest pairing percent (32.16%), dfls recovery (24.27%) and eggs recovery (52.11g/kg) for 12Y × BFC1 was found in March grainage season. For N × (SK6 × SK7) also the highest pairing percent (32.04%), dfls recovery (22.47%) and eggs recovery (50 g/ kg) was during March grainage season.

Grainage performance of 12Y × BFC1

SSPC	Grainage Season	Hybrid	Pair %	Dfls recovery (%)	Egg recovery (g/kg)	Dfls by no.	C: D Ratio
Berhampore	Oct 20	12Y × BFC1	28.04*	23.04*	46.94*	2300	5.65:1
		N × (SK6 × SK7)	20.17*	11.11*	25.4*	-	9.0:1
	Jan 21	12Y × BFC1	30.05	21.04	46.89	32900	4.75:1
		N × (SK6 × SK7)	31.96	20.11	45.04	-	4.97:1
	March 21	12Y × BFC1	32.16	24.27	52.11	41500	4.12:1
		N × (SK6 × SK7)	32.04	22.47	50	-	4.45:1
	June 21	12Y × BFC1	27.55	18.68	41.18	14100	5.11:1
		N × (SK6 × SK7)	26.98	18.56	42.5	-	5.23:1
	Oct 21	12Y × BFC1	26.72*	18.95*	41.81*	13000	5.28:1
		N × (SK6 × SK7)	22*	14.09*	32.06*	-	7.1:1
	Jan 21	12Y × BFC1	27.3	20.6	46.4	68900	4.86:1
		N × (SK6 × SK7)	26.4	18.5	41	-	5.41:1
		CD @ 1%	2.97	4.20	7.21	-	-
		CV (%)	12.64	24.44	19.34	-	-
Madanapalle	Jan 21	12Y × BFC1	30.1	32.9	61.5	54500	-

C:D ratio = Cocoons : dfls ratio

Irrespective of hybrids, the March grainage season was best for dfls recovery. But, the one crop taken in the Andhra Pradesh showed a highest egg recovery of 61.5 g/ kg showing the importance of climatic conditions.

Comparative performance of 12Y × BFC1 with M6DPC × (SK6 × SK7) in WB

Hybrid	Dfls	Yield/ 100 dfls	SCW (g)	SSW (g)	SR (%)
12Y × BFC1	165400	50.26	1.631	0.286	17.46
M6DPC × (SK6 × SK7)	191000	47.96	1.517	0.259	17.07
Improvement (%)	-	4.8	7.51	10.42	2.28

As suggested in the XXIV HAC meeting, the performance of 12Y × BFC1 was compared to the previously authorized crossbreed M6DPC × (SK6 × SK7). The perusal of the data revealed that, M6DPC × (SK6 × SK7) was found to be low productive in respect of all the quantitative characters including the cocoon yield. Comparison of the mean values data revealed a higher cocoon yield (4.8%) in 12Y × BFC1 (50.26 kg) over M6DPC × (SK6 × SK7). Similarly, the 12Y × BFC1 showed an improvement of 7.51%, 10.42% and 2.28% in cocoon weight, shell weight and shell percent, respectively.

Inference:

- The data on field testing of 2.29 lakh dfls of 12Y × BFC1 revealed an overall average cocoon yield of 45.31 kg against control [N × (SK6 × SK7)] of 40.28 kg with an improvement of 12.49%.
- Highest average cocoon yield of 57.11 kg was recorded in Arunachal Pradesh followed by 50.26 kg in West Bengal and 44.87 kg in Jharkhand.
- Results of two-way ANOVA revealed that irrespective of all the states, the cocoon yield and shell weight were significantly higher in 12Y × BFC1 compared to the control.
- Reeling traits assessed at CSTRI-Bangalore showed a notable improvement in reeling parameters of 12Y × BFC1 in comparison to control [N × (SK6 × SK7)].
- Significant differences were found among all the grainage parameters of 12Y × BFC1 and N × (SK6 × SK7) during October seasons.

- The performance of 12Y × BFC1 was superior in terms of rearing, reeling and grainage parameters in comparison to control. Therefore, 12Y × BFC1 an improved crossbreed can be recommended for rearing in commercial seasons of E & NE India.

Larval photos of 12Y × BFC1

Cocoon photos of 12Y × BFC1

Silk photos and crop inspection of 12Y × BFC1

Future plan:

The data on field performance of 2.29 lakh dfls of 12Y × BFC1 tested in E and NE India was presented in 24th hybrid authorization committee (HAC) meeting held at Central Office, CSB, Bengaluru. The 24th HAC committee recommended the improved crossbreed 12Y × BFC1 for authorization and commercial exploitation in E and NE India. As recommended the hybrid has to be popularised in E and NE India.

Ongoing Project

AIB 01009MI: Evaluation of new bivoltine double hybrid, TT21 × TT56 at farmers level for authorisation for commercial exploitation.

[April, 2020 to December, 2023]

CSRTI-Berhampore: N Chandrakanth (PI); **CSRTI-Mysuru**: KN Madhusudhan (PI), L Kusuma, MS Ranjini, & MN Chandrasekar; RSRS-Kodathi: V Chalapathy; RSRS-Ananthapur: KP Kiran Kumar; RSRS-Salem: Dhahira Beevi; RSRS-Mulugu: Praveen Kumar; RSRS-Chamarajanagar: Sivasubramanyam; NSSO-Bengaluru: Sasidharan Nair; RSRS-Sahaspur: RP Singh; RSRS-Jammu: Rita Singh.

Objective:

- To evaluate the performance of bivoltine hybrid, TT21 × TT56 in field for productivity and silk quality.

CSRTI-Mysuru has developed a robust thermo-tolerant bivoltine double hybrid, TT21 × TT56 through DNA marker assisted selection. During this year, a total of 10000 dfls of TT21 × TT56 were distributed among the farmers of West Bengal (9000) and Assam (1000) in Oct/Nov 2022 along with 500 dfls of FC1 × FC2. In West Bengal, the performance of TT21 × TT56 was better than the FC1 × FC2 in terms of cocoon yield. The average cocoon yield of TT21× TT56 was 47 kg per 100 dfls and that of FC1 × FC2 was 35 kg per 100dfls with an improvement of 34.29%. Similarly, in Assam, the performance of TT21 × TT56 was on par with FC1 × FC2 in terms of cocoon yield. The average cocoon yield of TT21 × TT56 was 38.82 kg per 100dfls and that of FC1 × FC2 was 35.22 kg per 100dfls with an improvement of 10.22%. The reeling parameters were at par with the control FC1 × FC2 in West Bengal and as well as Assam. Currently, a total of 5000 dfls of TT21 × TT56 were distributed among the farmers of Tripura (1400; Brushed on 05.03.2023) and Assam (3600; Brushed on 06.03.2023 in Mangaldoi and 13.03.2023 in Jorhat) during March, 2023. Brushing with >90% hatching was observed in Assam and Tripura. Rearing is completed and data collection is in progress. So far, the TT21 × TT56 hybrid performance in Eastern and North- Eastern India is satisfactory and acceptable.

State-wise Performance of TT21 × TT56 Double Hybrid (2022)

State	Hybrid	Crop	Dfls	Farmer (no)	Yield/ 100 dfls	SCW (g)	SSW (g)	SR (%)	FL (m)	Denier (d)	Reel-ability (%)	Ren-ditta (kg)	Raw silk (%)
West Bengal	TT21 × TT56	01	9000	50	47	1.578	0.358	22.69	856	2.91	77	6.5	15.5
	FC1 × FC2		500	10	35	1.621	0.372	21.73	788	2.95	78	7	14.2
	IOC %				**34.29**	**-2.7**	**-3.8**	**4.42**	**8.65**	**-1.36**	**-1.5**	**-7.1**	**8.92**
Assam	TT21 × TT56	01	1000	10	38.82	1.699	0.334	19.66	Self reeled by the farmers				
	FC1 × FC2		100	01	35.22	1.730	0.342	19.77					
	IOC %				**10.22**	**-1.8**	**-2.3**	**-0.6**	**-**	**-**	**-**	**-**	**-**

AIE 02018SI: Identification of superior bivoltine foundation cross as a male component to improve crossbreed productivity in Eastern & North Eastern India.

[May, 2022 to October, 2024]

CSRTI-Berhampore: N. Chandrakanth (PI), Satadal Chakraborty (Co-PI), Th. Ranjita Devi, V.S. Raviraj and Anwar Hussain (Project Assitant) and incharges of RSRSs and RECs.

Objectives:

- To identify and evaluate the superior bivoltine foundation crosses (FCs) with high shell content in E & NE India.
- To identify and evaluate the superior crossbreed (CB) produced by utilizing the identified bivoltine FCs as male component in E & NE India.

Ten breeding lines were developed in an exploratory study conducted at CSRTI-Berhampore during 2020-22. Based on the shell content (>18%) and survival (>80%), 7 breeds namely NFC8(D), NFC11(P), NFC18(P), NFC19(D), NFCR(D), NFC12(M) and NFC18(M) were shortlisted from ten newly developed silkworm breeds. Using them, dumbbell FCs were prepared and reared during August, 2022. Based on the shell content (>19%) and survival (>85%), three FCs namely NFC11(P) × NFC18(P), NFC19(D) × NFCR(D) and NFC18(M) × NFC12(M) were identified as potential male components. The shortlisted FCs was reared during Dec., 2022. The shell percent of 20.93% for NFC11 (P) × NFC18 (P), 18.75% for NFC19 (D) × NFCR (D) and 20.28% for NFC18 (M) × NFC12 (M) was recorded. Similarly, the ERR by number was 7000 for NFC11 (P) × NFC18 (P), 9367 for NFC19 (D) × NFCR (D) and 8800 for NFC18 (M) × NFC12 (M). The ERR by number was less in NFC11(P) × NFC18(P) and shell percent was less in NFC19 (D) × NFCR (D). Therefore, NFC18 (M) × NFC12 (M) with moderate shell and survival was selected for further evaluation. First trial of crossbreed evaluation by using 12Y as female parent with ten bivoltine combinations analyzed through MTEI index and heterosis revealed 12Y × (NFC11P × NFC18P), 12Y × (NFC19W × NFCRW) and 12Y × (NFC12M × NFC18M) as best performing improved crossbreeds (ICBs) for increasing the cocoon yield. Rearing of the above three FCs viz., NFC11(P) × NFC18(P), NFC19(D) × NFCR(D) and NFC18(M) × NFC12(M) is in progress.

Performance of NFC breeds (August, 2022)

Breed	Larval Marking	ERR No.	ERR Wt. (kg)	SCW(g)	SSW (g)	Shell (%)
NFC8(W)	Plain	7454	8.110	1.204	0.218	18.11
NFC8(D)	Plain	8122	8.335	1.224	0.221	18.05
NFC11(P)	Plain	8016	9.780	1.317	0.250	18.98
NFC12(W)	Marked	8210	10.060	1.331	0.250	18.78
NFC18(M)	Marked	8100	9.040	1.389	0.254	18.29
NFC18(P)	Plain	8800	10.140	1.460	0.277	18.97
NFC19(D)	Plain	8712	10.340	1.379	0.258	18.71
NFC19(W)	Plain	8550	10.140	1.269	0.224	17.65
NFCR(D)	Plain	9033	11.240	1.436	0.272	18.94
NFCR(W)	Plain	8600	10.750	1.476	0.275	18.63
SK6	Plain	8200	10.450	1.393	0.229	16.44
SK7	Plain	8440	10.750	1.376	0.225	16.38
BCon1	Plain	8050	11.320	1.518	0.242	15.94
BCon4	Plain	7166	1.710	1.469	0.252	17.15

Performance of Bivoltine Foundation Crosses (FCs) (August, 2022)

#	FC	Fec	Hat (%)	ERR No.	ERR (kg)	SCW (g)	SSW (g)	SR (%)	FL (m)	NBFL (m)	Den -ier	Raw Silk (%)	Ren -ditta (kg)	Reel ability (%)	Neat- ness (p)	Mean MTEI
1	NFC8(D)x19(W)	479	93.80	7147	8.333	1.334	0.234	17.56	559	559	2.67	12.95	7.72	77.39	95	51.56
2	NFC11(P)x18(P)	490	92.40	8540	10.533	1.299	0.262	20.15	667	667	2.52	12.77	7.83	70.72	95	57.76
3	NFC18(P)x11(P)	503	95.70	6187	7.667	1.289	0.250	19.40	731	568	2.50	12.24	8.17	72.38	95	52.48
4	NFC12(M)x18(M)	531	97.35	8227	9.800	1.197	0.206	17.18	625	481	2.49	12.29	8.14	71.89	95	46.94
5	NFC18(M)x\12(M)	439	96.45	8587	12.067	1.379	0.258	18.70	649	593	2.66	12.13	8.24	76.49	95	59.13
6	NFC 19(D) x R(D)	447	94.95	8553	10.800	1.339	0.255	19.08	758	596	2.45	12.02	8.32	77.19	95	54.37
7	NFC R(D) x 19(D)	483	96.65	5800	7.333	1.405	0.228	16.23	548	446	2.55	11.90	8.40	76.64	95	46.53
8	NFCR(W)x 19(W)	437	93.95	6427	8.667	1.331	0.219	16.43	532	532	2.61	11.94	8.37	76.95	95	44.44
9	NFC19(W)x R(W)	477	95.85	4080	5.400	1.262	0.224	17.77	550	550	2.54	12.06	8.29	69.95	95	46.36
10	SK6 x SK7	482	97.57	8374	10.267	1.187	0.187	15.75	572	572	2.45	10.24	9.76	68.29	95	48.42

Performance of Bivoltine Foundation Crosses (FCs) (Dec 2022)

#	FC	Fec	Hat(%)	ERR	ERR	SCW	SSW	SR
1	NFC 8(D) x 19(W)	489	94.40	7115	9.766	1.444	0.246	17.04
2	NFC 11(P) x 18(P)	511	95.20	8665	10.906	1.409	0.274	19.45
3	NFC 18(P) x 11(P)	506	93.30	7333	9.887	1.399	0.262	18.73
4	NFC 12(M) x 18(M)	534	97.65	8347	10.7	1.307	0.218	16.68
5	NFC 18(M) x 12(M)	498	97.55	8997	12.87	1.489	0.298	20.01
6	NFC 19(D) x R(D)	488	97.05	8786	11.325	1.449	0.277	19.12
7	SK6 x SK7	492	96.37	8332	10.287	1.397	0.217	16.73

Performance of Crossbreeds (Oct., 2022)

#	Crossbreed	Fec	ERR No.	ERR (kg)	SCW (g)	SSW (g)	SR (%)	FL (m)	NBFL (m)	Den -ier	Raw Silk (%)	Ren -ditta (kg)	Reel -ability (%)	Neat- ness (p)	Mean MTEI
1	12Yx(NFC8W x 19W)	403	8583	12.79	1.400	0.257	18.41	596	596	2.90	12.45	8.03	78.49	95	45.64
2	12Y x (NFC11P x 18P)	409	9643	14.16	1.442	0.255	17.67	786	786	2.69	13.47	7.43	79.67	95	59.49
3	12Y x (NFC18P x 11P)	368	8762	13.57	1.487	0.260	17.44	732	732	2.63	12.80	7.81	77.97	95	52.58
4	12Y x (NFC12M x 18M)	372	9917	14.07	1.384	0.232	16.80	635	635	2.79	13.46	7.43	81.78	95	51.14
5	12Y x (NFC18M x 12M)	339	9143	12.91	1.346	0.236	17.53	666	666	2.67	12.79	7.82	81.27	95	47.83
6	12Y x (NFC19D x RD)	405	9321	13.32	1.419	0.248	17.45	688	688	2.74	13.52	7.40	80.38	95	53.17
7	12Y x (NFCRD x 19D)	383	9488	13.57	1.432	0.258	18.04	586	586	2.83	13.79	7.25	78.57	95	51.74
8	12Y x (NFC19W x RW)	409	9619	13.51	1.333	0.230	17.21	704	704	2.82	12.84	7.79	80.22	95	48.70
9	12Y x (NFCRW x 19W)	384	8238	11.54	1.354	0.236	17.42	717	717	2.75	12.84	7.79	80.45	95	45.08
10	12Y x BFC1	426	8859	13.11	1.371	0.229	16.69	691	691	2.73	12.79	7.82	79.07	95	44.62

Continuous/Other Activities:

Bivoltine Germplasm: Twenty-six bivoltine silkworm germplasm stocks are maintained at CSRTI-Berhampore. These batches are reared in October, 2022 (3 composite batches; 250 larvae after III moult) following standard rearing conditions. Stringent selection was performed on the cocoons confirming to original breed characteristics were utilized for oviposition and dfls were produced. As per the requirement of all the experimental purposes, the layings were preserved under various hibernation schedules. The breeds which are performing better in particular trait could become parent resources for trait improvement breeding programmes.

Rearing performance of Germplasm Stocks (2022-23)						
Race / Breed	**Fec (No)**	**ERR (No)**	**ERR Wt (Kg)**	**Cocoon Wt (g)**	**Shell Wt (g)**	**Shell (%)**
Oval Breeds						
KPG A	476	4533	7.60	1.272	0.203	15.96
Gen 3	453	4840	7.747	1.248	0.272	21.79
CSN	393	4933	6.133	1.104	0.212	19.20
NBO 1	375	4333	6.133	1.229	0.198	16.11
NBO 4	383	3640	4.533	1.116	0.198	17.74
SB 1	353	2747	5.833	1.53	0.360	23.95
SK3	515	5760	9.533	1.405	0.246	17.51
KSO 1	536	5760	8.467	1.353	0.231	17.07

Rearing performance of Germplasm Stocks (2022-23)

Race / Breed	**Fec (No)**	**ERR (No)**	**ERR Wt (Kg)**	**Cocoon Wt (g)**	**Shell Wt (g)**	**Shell (%)**
Dumbbell Breeds						
BHR 1	503	3787	5.200	1.349	0.248	18.34
BHR 3	548	2320	3.767	1.175	0.209	18.46
SK (SL)Y	328	6200	7.200	1.189	0.220	18.50
NB18	373	5107	6.667	1.216	0.192	15.79
NP2	530	4787	6.867	1.139	0.226	19.84
D6(P)N	403	7853	10.267	1.142	0.197	17.25
SK4C	323	2240	4.750	1.183	0.202	17.07
Chinese PN	424	6787	9.667	1.227	0.210	17.11
CSR 47	496	4200	6.133	1.164	0.207	17.78
SK4	487	1533	6.000	1.376	0.226	16.42
DUN 22	413	6787	7.533	1.126	0.182	16.16
NB4D2	446	7933	11.150	1.324	0.236	17.82
YB	476	6413	8.667	1.278	0.220	17.21
RSJ 11	461	2933	4.917	1.305	0.229	17.55
SK6	647	8105	10.650	1.276	0.213	16.69
SK7	670	8592	11.972	1.288	0.206	15.99
B Con 1	654	4933	10.857	1.422	0.237	16.67
B Con 4	587	6453	9.467	1.377	0.235	17.07

AIB 02006 MI: Improvement of Nistari lines for survival and silk productivity.

[June, 2020 to May, 2024]

Th. Ranjita Devi (PI)

Coordinators: Kishor Kumar, C.M., A. K. Verma (till Dec., 2020), Gautam Mitra (till Nov., 2020), K. Rahul, Pooja Makwana, Mihir Rhaba and Chandra Shekar (CSRTI-Mysuru)

Objectives:

- To develop Nistari lines for improved survival and silk productivity.
- To evaluate improved Nistari crossbreeds for productivity traits.

Rearing performance of Improved Nistari marked and Plain lines were observed in both favourable and unfavourable seasons. The survival of the Improved Lines against BmNPV is above 60%. The given improved values of the desired traits are against the bench mark values documented in the tables.

Rearing performance of Improved Nistari Marked line

Seasons	Fecundity	Pupation	Avg.SCW	Avg. SSW	Shell Ratio	FL (m)
Bench Marks	392-400	81-83	0.9-1.1	0.1-0.115	11-12	300-350
April 22- May 22	470	97	1.00	0.14	14.00	427
June 22 -July 22	481	97	1.02	0.16	15.64	436
Aug 22-Sep 22	473	96	0.91	0.15	16.45	426
Oct 22-Nov 22	466	97	1.24	0.17	13.68	467
Jan 23-Feb 23	488	97	1.27	0.17	13.86	438
Mean	476	97	1.1	0.16	14.72	439
SD	8.85	0.45	0.16	0.015	1.24	16.63
CV%	1.86	0.46	14.52	9.17	8.44	3.79

Rearing performance of Improved Nistari Plain line

Seasons	Fecundity	Pupation	Avg.SC	Avg. SSW (g)	Shell Ratio	FL (m)
Bench Marks	382-390	86-88	0.9-1.2	0.1-0.12	11-12.50	300-350
April 22- May 22	465	96	1.1	0.14	13.08	417
June -July 22	479	98	1.05	0.14	13.33	447
Aug-Sep 22	473	96	0.91	0.14	15.75	422
Oct -Nov 22	461	95	1.22	0.16	13.11	467
Jan-Feb 23	473	98	1.24	0.17	14.07	442
Mean	470	97	1.10	0.15	13.87	439
SD	7.16	1.34	0.13	0.01	1.13	20.19
CV%	1.52	1.39	12.14	9.89	8.11	4.60

Rearing performance of Improved Nistari lines in favorable and Unfavorable Seasons

Seasons	Nistari	Fecundity	Pupation	Avg.SCW	Avg. SSW	Shell Ratio	FL (m)
Favourable	Marked	477	97	1.257	0.17	13.60	453
	Plain	467	97	1.229	0.17	13.93	455
Unfavourable	Marked	475	97	1.0	0.15	15.0	430
	Plain	472	97	1.0	0.14	14.0	429

Rearing performance was analyzed in Favourable and Unfavourable seasons seperately. The difference in the values of the desired traits of the Nistari Lines in Favorable and Unfavorable seasons implies the impact of seasonal effects on the desired traits. Comparative analysis was made between desired traits from directional selected and unselected population in Jan.-Feb., 2023. Minimum differences were observed among the traits between the two populations suggesting the stabilization of the values of these traits which will be observed further.

Comparative analysis of desired traits in selected and unselected population of Nistari

Nistari Line	Population	Avg.SCW (g)	Avg. SSW (g)	Shell Ratio (%)	FL (m)
Marked	Selected Population	1.27	0.17	13.38	438
	Unselected Population	1.22	0.17	13.93	444
Plain	Selected Population	1.24	0.17	14.07	442
	Unselected Population	1.27	0.17	13.38	431

Continuous/Other Activities:

Maintenance of Multivoltine Germplasm:

Bombyx mori multivoltine germplasm breeds (21) were maintained for 4 generation in 2022-2023. The average values of rearing performance of the four generations are depicted in the table. The Fecundity of the breeds ranges from 359 to 460.

Rearing performance of multivoltine germplasm accessions (2022-23)

Race/ Breed	Fecundity (No.)	Hatching (%)	Cocoon Wt.(g)	Shell Wt. (g)	Shell (%)	ERR (kg)	Pupation (%)
Cambodge	359	93	0.976	0.122	12.50	5.071	89
CB5	375	96	1.110	0.147	13.24	5.594	86
M12W	418	94	1.165	0.148	12.70	7.647	90
M6M81	374	95	1.109	0.133	11.99	8.118	86
M6DPC	366	96	1.147	0.142	12.38	6.114	89
OS616	451	96	1.22	0.182	14.91	8.447	90
M. Con 4	419	95	1.176	0.187	15.98	6.057	85
O	438	95	1.117	0.144	12.97	8.140	91
G	423	96	1.037	0.129	12.43	7.408	92
M15	460	96	1.032	0.137	13.27	5.686	86
M6DPC(gr.)	456	97	1.028	0.151	14.68	7.722	89
SARUPAT	455	95	1.043	0.148	14.18	6.752	91
A-23	417	96	1.007	0.126	12.60	6.072	86
A-25	381	96	1.052	0.139	13.21	5.347	85
21Y	450	96	1.128	0.160	14.184	8.031	91
8W	365	95	1.077	0.168	15.59	6.863	91
28(RY)	432	95	1.158	0.162	13.98	5.169	83
N (Marked)	429	96	1.021	0.159	15.27	5.011	92
N (Plain)	433	96	1.028	0.142	13.81	7.074	91
N (Chalsa)	450	96	1.038	0.142	13.92	5.900	90
N (Debra)	458	97	1.10	0.145	13.18	6.41	92

Basic Seed Supply:

A total of 3360 P1/P2 dfls of multivoltine (Nistari Marked, Nistari Plain, 12y) and **1605** Bivoltine (SK6, SK7, SK6 x SK7, B.Con1, B.Con4, B.Con 1x4, BFC1) basic seeds were supplied to NSSO, DoSs and nested units of CSB on demand.

FARM MANAGEMENT AND REARING & SEED TECHNOLOGY

Dr. Satadal Chakraborty

APS02020MI: Improvement of seed crop productivity in West Bengal.

[November, 2022 to October, 2025].

Co-Ordinators: Kishor Kumar C.M. and Anath Nath Mandal.

Satadal Chakraborty (PI), Th. Ranjita Devi, P.Naik , B.V.Naidu , M.Rabha , K. Alam, H. Babu and other eleven Scientists / Officers of CSB & DoS, West Bengal.

Objectives:

- To improve quality of multivoltine and bivoltine seed cocoons crops.

- To improve sustainable production of commercial hybrid dfls in West Bengal.

Two hundred (200) seed farmers (Bivoltine – 140 and Multivoltine-60) have been selected to implement the improved technological means under the project in consultation with DoS, West Bengal. Among them, 80 Bivoltine farmers are from North Bengal in the districts of Kalimpong (30), Darjeeling Hill (10), Darjeeling Plain/Siliguri (10) Jalpaiguri (20) and Coochbehar (10) and 120 farmers are from traditional districts of West Bengal viz., Malda (35), Nadia (35), Birbhum (25) and Murshidabad (25). Joint verification with DoS, West Bengal of 190 seed farmers have been completed at the end of the year 2022-23. Seed farmers have been given specialized training for 5 days and 1st batch of residential training of Seed farmers of Murshidabad and Nadia district has been conducted at this Institute during 20.03.2023 to 24.03.2023. Scientists / Officers of CSB / DoS have taken theoretical / practical classes. Training of 60 seed farmers of Malda and Birbhum districts (2nd batch) and 30 seed farmers of Kalimpong district (3rd batch) have been finalized during 2nd week of May, 23 and 3rd week of June, 23 respectively.

HOST PLANT PROTECTION

Ongoing Projects:

ARE01028MI: Recommendation of novel fungicidal and insecticidal application for mulberry (Collaborative project with CSR&TI, Mysore).

[May, 2022 to April, 2025]

Khasru Alam (PI) and Raviraj, V. S.

Objective:

- Identification of novel fungicides and insecticides for mulberry crop protection.

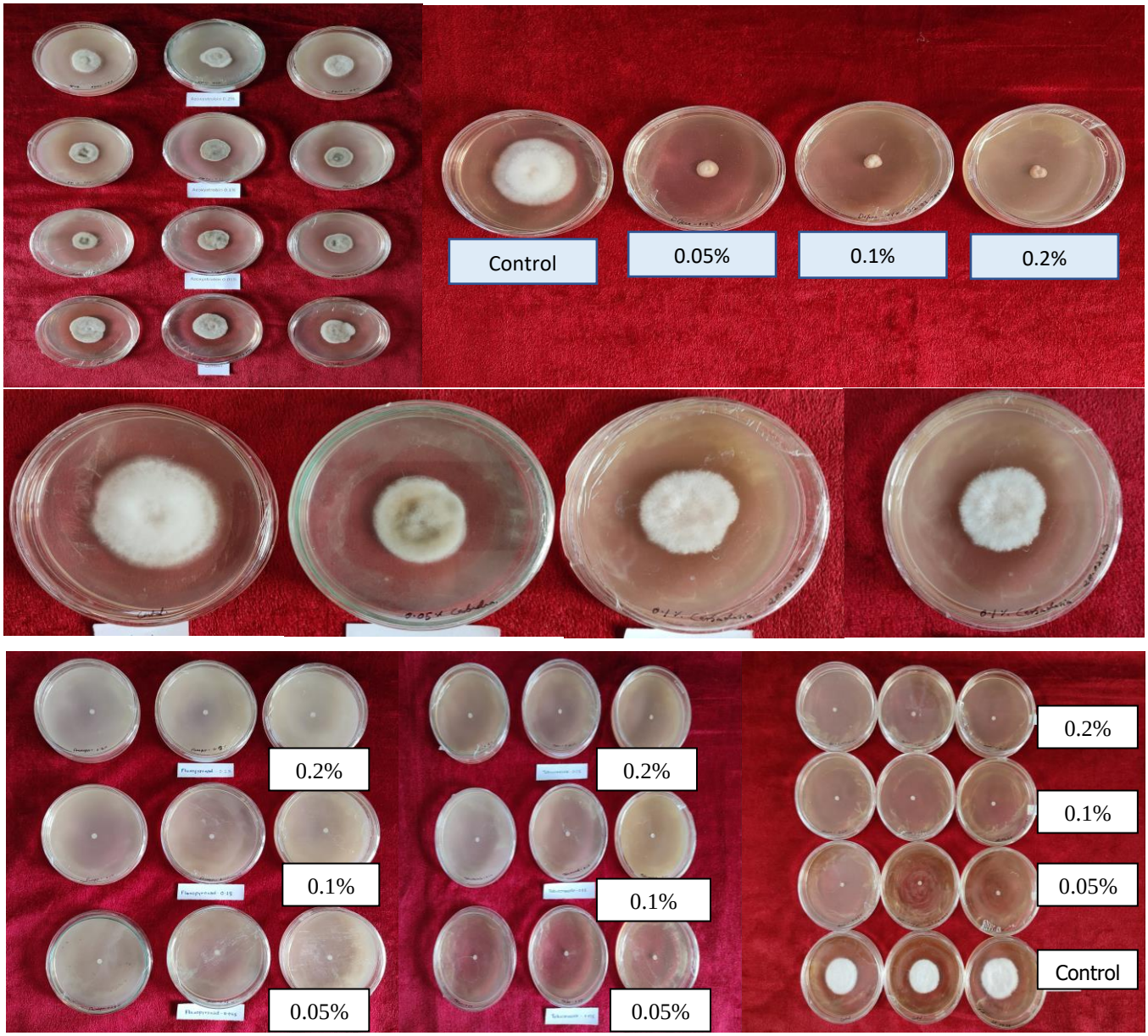
In mulberry considerable leaf yield losses are being experienced due to incidence for both diseases and pest. Individually diseases like Powdery mildew, Brown leaf spot, black leaf spot, Brown leaf rust (*Peridiospora mori*), Cercospora leaf spot (*Cercospora moricola*) are capable of infliciting 10-15% loss depending on severity. Similarly, pests of mulberry like mealy bug, thrips and whiteflies posing serious threat to mulberry production. The present recommendations for mulberry crop protection both for management of diseases and pests were worked out long back and involve chemicals which are either banned or facing an imminent ban. Therefore, the present project trying to screen out new chemicals which are effective at lower doses with less toxicity to the silkworm and environment.

So far six fungicides namely Azoxystorbin, Difenoconazole, Fluxapyroxad, Tebuconazole, Hexaconazole along with Bavistin as existing recomenadation has been evaluated under laboratory condition against leaf spot disease of mulberry. Initially leaf spot (*Myrothecium roridum*) infected samples were collected from the fields and fungal pathogens were isolated in PDA media by following standard procedure. *In vitro* evaluation of fungicides namely Azoxystorbin, Difenoconazole, Fluxapyroxad, Tebuconazole, Hexaconazole along with existing recommended fungicide Bavistin were performed using poisoned food technique. No mycelial growth (0.00%) was observed with Tebuconazole, Fluxapyroxad and Hexaconazole treated plate at all three concentrations 0.05%, 0.1% and 0.2% after 96 hours of treatment. Whereas Bavistin has provided 14.62, 25.97, 35.90%, Azoxystrbin provided 24.44, 30.92, 31.73% and Difenoconazole provided 71.51, 78.10 and 77.80% mycelial radial growth inhibition at 0.05%, 0.1% and 0.2% concentration after 96 hours of treatment.

In vitro evaluation of fungicides against leaf spot of mulberry

Fungicides	Mycellial radial growth inhibition (%)		
	0.05%	0.10%	0.20%
Azoxystrobin	24.44	30.92	31.73
Difenoconazole	71.51	78.10	77.80
Bavistin	14.62	25.97	35.90
Fluxapyroxad	100.00	100.00	100.00
Tebuconazole	100.00	100.00	100.00
Hexaconazole	100.00	100.00	100.00
Mean	**68.43**	**72.50**	**74.24**
CD @5%	**0.75**	**1.39**	**0.76**
CV%	**0.74**	**1.29**	**0.69**

Inhibitory effect of fungicides on radial growth of *Myrothecium*



A= Azoxistorbin, B= Difenoconazole, C= Bavistin, D= Fluxapyroxad, E= Tebuconazole, F= Hexaconazole

Continuous/Other Activities:

Survelliance and forewarning of mulberry diseases and pests of E & NE India.

Khasru Alam (PI), I/C of RSRSs & RECs of CSRTI-BHP

Objective:

- To have Survelliance of mulberry diseases and pests in E & NE India and providing forewarning services to the farmers for effeictive management of mulberry diseases and pests in Eastern & North Eastern India.

Data on mulberry disease incidence was collected at weekly intervals across Eastern and North-Eastern India. Prevalence of major diseases *viz*., *Myrothecium* Leaf Spot (MLS), Bacterial Leaf Spot (BLS), C*ercospora* Leaf Spot (CLS), Powdery Mildew (PMLD) Brown Leaf Rust (BLR) and yellow leaf Rust (YLR) were recorded and diseases severity was assessed in terms of Percent Disease Index (PDI).

State	Unit	MLS	BLS	CLS	PMLD	BLR	YLR
	CSRTI-BHP	5.48 (July)	8.87 (Jul)	5.58 (Nov)	8.85 (Nov)		
West Bengal	Malda	3.32 (Aug)	4.58 (Aug)		7.65 (Dec)		
	Kalimpong				6.28 (Jul)	8.45 (June)	2.08 (Nov)
Odisha	Koraput				3.95 (Nov)	4.25 (Sep)	
Mizoram	Aizawl				2.26 (Sep)		
Manipur	Imphal				4.11 (Oct)		
Meghalaya	Shillong	2.35 (Aug)			1.75 (Sep)		
Agartala	Agartala	4.46 (Aug)					
Assam	Jorhat	28.58 (Dec)			18.86 (Dec)	23.74 (Dec)	
Assam	Mangoldoi	4.21 (Dec)			2.66 (Dec)	5.08 (Dec)	

Similarly, data on pest incidence was collected from the farmers' fields of different locations as well as Institute fields. Collection of data were made from five randomly selected plants per sample and the seasonal incidence of major mulberry pests *viz*., thrips (*Pseudodendrothrips mori*), mealy bug (*Maconellicoccus hirsutus*) and whitefly (*Dialeuropora decempuncta* & *Aleuroclava pentatuberculata)* and root mealy bug (*Paraputo* spp.*)* in Kalimpong and Mamring were collected at weekly intervals along with meteorological data.

Seasonal occurrence of major pests in mulberry Ecosystem (2022-23)

Location	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Range
Thrips (no./leaf)													
Institute	23.07	11.84	13.84	2.8	1.34	0.65					0.8	10	0.8-37
Malda	1.21	2.23	3.63	6.73	7.47								0-8.47
Koraput		5.48						4.31	3.05			4.68	0-6.11
Tukra (%)													
Institute		12.3	37.57	38.52	18.52	8.37						5.25	0-41.2
Malda	0.04	7.33											0-11.54
Kalimpong (RMG*)	1.38	1.04	1.37	1.21	2.46	2.48	1.88	1.53	0	0	0.98		0-8.85
Koraput		5.83				2.04			4.19				0-7.23
Shilong				0.57		0.75	2.05						0-3.87
Whitefly (no./leaf)													
Institute					0.82	0.87	3.09	8.75		6	1.2	0.9	0.8-9.54
Koraput		4.05						3.67	3.04				0-5.68
Imphol					0.37	0.62	0.68						0-0.72

From each plant three twigs (shoots) were selected for recording the data. From each twig, number of thrips per leaf (from top 4th, 5th, 6th, 7th, leaf) was recorded. Incidence of Tukra was worked out based on the percentage of shoots damaged in ten plants per holding. Five affected shoots per holding were collected from the field for counting egg masses, nymphs & adults of mealy bug. Whitefly incidence was recorded based on *a*dult and late nymph population of whitefly from top, middle and bottom two leaves from three twigs/ plant.

SILKWORM PATHOLOGY

Concluded Project:

AIT08005MI: Development and evaluation of Bidensovirus resistant silkworm hybrids developed from marker assisted breeding lines - Phase II *(Collaboration from SBRL-Kodathi with CSRTI-Berhampore & CSRTI-Mysore)*

[March, 2020 to February, 2023]

K.S. Tulsi Naik (PI-SBRL-Kodathi), A. Ramesha (CI-SBRL-Kodathi); M.N. Chandrashekar, M.S. Ranjini (CIs-CSRTI-Mysore); K. Rahul, M. Rabha (CIs-CSRTI-Berhampore)

Objectives:

- Evaluation of BmBDV resistant lines/hybrids at respective locations with virus exposure studies.
- BmBDV marker inheritance analysis in hybrids.
- Maintenance of BmBDV lines at breeding units with MAS.

Bombyx mori bidensovirus (BmBDV) is one of the flacherie disease causing agents in mulberry silkworms that cause crop loss to sericulture farmers. The resistance in mulberry silkworms to BmBDV is governed by a major homozygous recessive gene, *nsd*-2 which was confirmed through positional cloning. Therefore the silkworm breeds with *nsd*-2 resistant allele in heterozygous condition were identified and selectively bred by marker assisted breeding. As a collaborator (CSR&TI, Berhampore), our aim was to screen and identify BmBDV resistant silkworm breeds (bivoltine and multivoltine) developed by CSR&TI-Berhampore that were suitable for tropical conditions through marker assisted breeding. In this direction, initially productive silkworm breeds were utilized and screened for the presence of *nsd-2* resistant allele. A total of 20 bivoltine breeds and 6 multivoltine breeds were subjected to screening. Out of 20 bivoltine breeds, 10 bivoltine breeds (SK6, SK7, SK6xSK7, B.Con 1, B.Con 4, NFC8, NFCR, BHP8, BHP9 and BHP-FC2) were found positive for the presence of BmBDV resistance marker. Where, in case of multivoltine breeds, out of 6 breeds, only one multivoltine breed (12Y) was found positive for the presence of BmBDV resistant marker. The screening of these breeds in our study proved the prevalence of *nsd-2* resistant allele in both homozygous and heterozygous conditions especially in Indian bivoltine silkworm breeds as reported earlier.

Surival rate (%) after BmBDV exposure

#	Breeds	Survival rate (%)	
		Oct.-Nov., 22	Dec.-Jan., 23
1	SK6R x SK7R	60	65
2	SK6-R	51	55
3	SK7-R	50	54
4	BHP-8	48	50
5	B.Con 4	38	42
6	B.Con 1	16	21
7	BHP9	17	24
8	NFC-R	10	15

These marker- positive breeds were subjected to bioassay studies in order to evaluate their tolerance to BmBDV. Bioassay was performed through per oral (*per os*) inoculation, where BmBDV solutions were prepared (10^{-2} dilution) and smeared onto mulberry leaves. The inoculated leaves were partially dried and fed to the III instar- 0 day larvae in three replicates for each breed (100 larvae/ treatment). The control

batches for each breed were also maintained without viral exposure. Treated larvae were regularly observed till spinning and the mortality was recorded daily. The highest survival rate was recorded in SK6R x SK7R (65%), followed by SK6R (55%), SK7R (54%) and BHP-8 (50%) during Agrhayani crop (Dec.-Jan., 2023). The multivoltine breed 12Y couldn't survive in the bioassay studies probably due to pathogens other than BmBDV. In the uninfected control, the survival was more than 80% in first (Oct.-Nov., 2022) and second crop (Dec.-Jan., 2023), respectively.

Conclusion:

Bioassay experiments synchronized with marker presence showed better BmBDV tolerance in SK6 and SK7. It is suggested to prepare bivotine hybrids of SK6R x SK7R and test in field (OST) to protect larvae from viral flacherie and to use them as parents in breeding programs.

Ongoing Projects:

Pilot study: Extraction of pharmaceutical grade sodium copper chlorophyllin from silkworm feculae.

[October, 2022 to March, 2023]

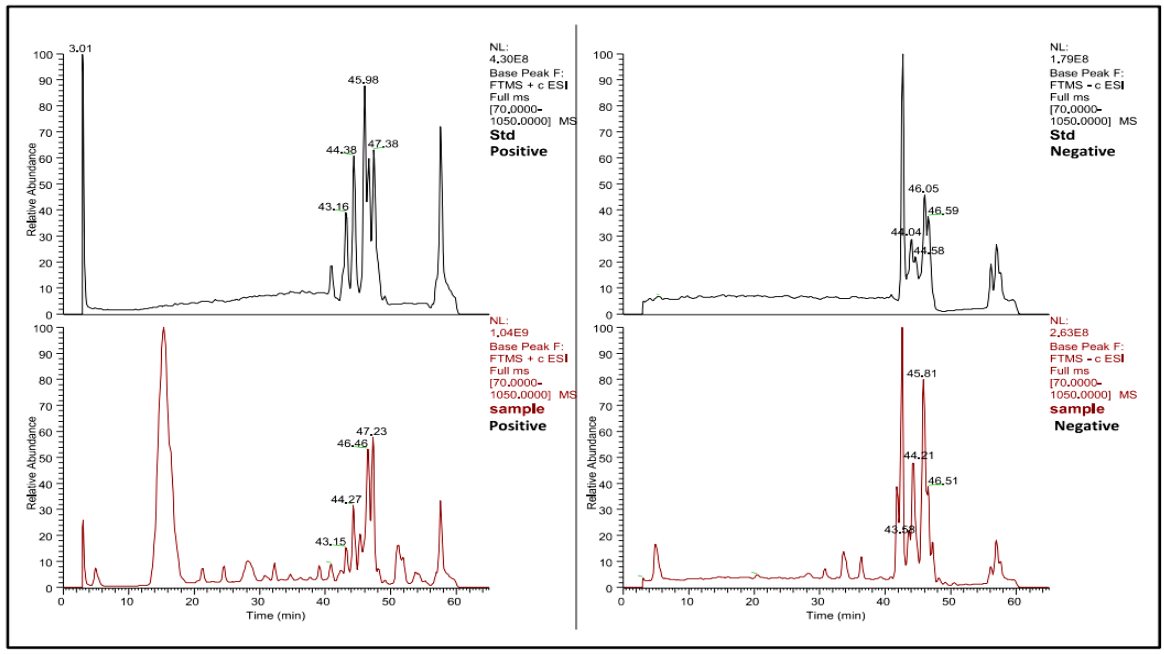
Mihir Rabha (PI), K. Rahul, Khasru Alam and A.R. Pradeep.

Objectives:

- To extract sodium copper chlorophyllin from silkworm feculae.
- To characterize and improve the quality standard of the synthesized SCC.

Sodium Copper Chlorophyllin (SCC) is a semi-synthetic derivative of chlorophyll and has a wide application in pharmaceuticals besides being used a food colorant. In the past 50 years, Chinese have pioneered in production of SCC and globally they are the leading exporters of the same. Despite small scale production of SCC locally from sources other than silkworm excreta, India depends on countries like USA, China, Spain and Germany for import of SCC. There is a huge demand for SCC in our country and as a second largest producer of raw silk, a huge quantity of mulberry silkworm excreta is generated every year in India. Standardizing a process for the extraction of SCC was deemed necessary to augment local production of SCC as well as to generate extra revenue for the seri farmers. Hence a pilot study was planned to develop a process/technology for the extraction of SCC from silkworm feculae at laboratory level.

In the present investigation, SCC was extracted from 100 g of silkworm feculae in organic solvents (Acetone/Methanol) followed by addition of copper with 10% $CuSO_4$ solution. Subsequently, the mixture was processed through different steps including saponification, filtration, washing and drying. The final extract was submitted to CCAMP-Bangalore for purity analysis through LCMS and NMR. The report of the analyses showed presence of several additional peaks indicative of impurities along with extracted sample in comparison to standard (SCC-Sigma make) showing lack of economic feasibility in production of pharmaceutical grade SCC from silkworm feculae.



CMS chromatogram for sample showing additional peaks in comparison with standard (SCC sigma make)

Continuous/Other Activities:

Silkworm disease monitoring of seed and commercial crops in E & NE states.

Executive Authority: Dr. Kishor Kumar C.M., Director-CSRTI-Berhampore

Investigators: CSRTI-Berhampore: K. Rahul, M. Rabha, A. R. Pradeep, Incharges of RSRSs @ Kalimpong, Koraput & Jorhat; Incharges of RECs @ Mothabari-West Bengal, Shillong-Meghalya, Dimapur-Nagaland, Agartala-Tripura, Aizawl-Mizoram, Imphal-Manipur, Mangaldoi-Assam & Bhandra-Jharkhand.

NSSO-Bangalore: Incharges of SSPCs @ Berhampore & D.B. Pur; Incharges of BSFs @ Ambari falakata, Karnasubarna & Dhubulia.

DoT(Seri)-West Bengal: Swapan Kr. Maity (Murshidabad), Biplab Sarkar (Birbhum), Debasis Chanda (Nadia), Abhijit Goswami (Malda), Sujit Saha (U & D Dinajpur), Probodh Kr. Sahu (Jalpaiguri), Sanjib Kr. Barman (Cooch behar), Prahllad Lama (Darjeeling) & Sajal Roy (Midnapore).

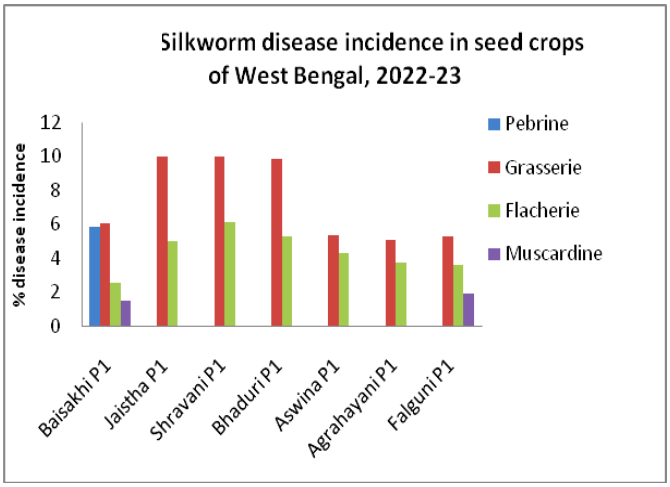
Objectives:

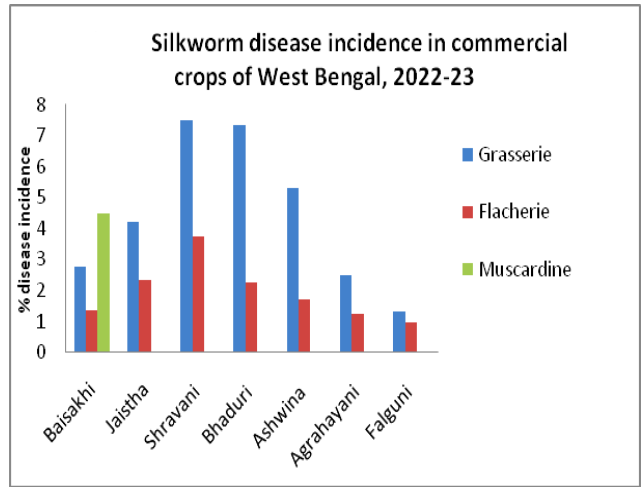
- To estimate the prevalence of silkworm diseases (seed & commercial crops) in Eastern & North-Eastern states.
- To suggest remedial measures on spot to the farms/farmers for the management of silkworm diseases and prevent disease outbreak(s).

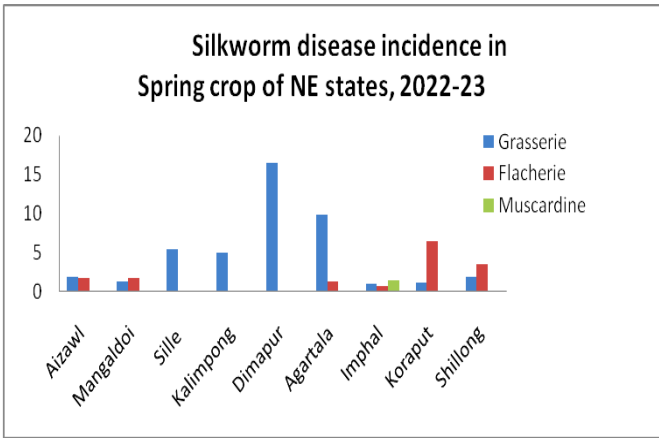
Silkworm disease monitoring of seed and commercial crops in East & NE states was undertaken with an aim to manage the mulberry silkworm disease incidence across different seed and commercial crops in co-ordination with Central Silk Board (CSRTI-Berhampore & NSSO-Bangalore) and DoSs of respective states. A total of 769 samples across different seed crops from seed farmers, DoS farms and DoS grainages of West Bengal were microscopically examined during the year in West Bengal. Moth examination showed 5.8% pebrine incidence. The highest mortality due to grasserie was recorded in Shravani P1 (8.25%) followed by Bhaduri P1 (6.59%). Flacherie incidences were also highest during the

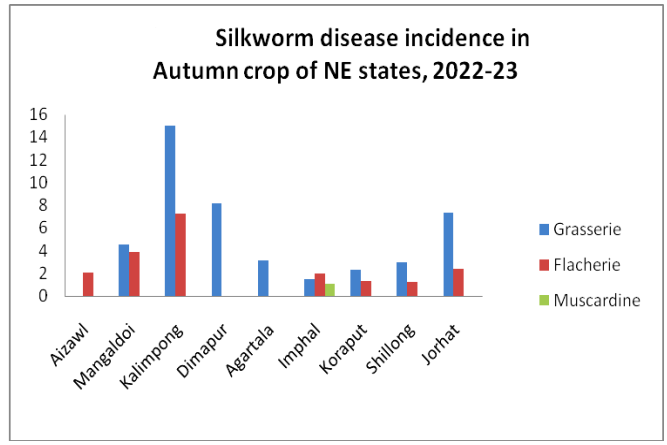
aforementioned two crop seasons [Sharvani P1 (6.1%); Bhaduri P1 (5.25%)]. The incidences of muscardine was reported in Falguni P1 (1.92%) and Baisakhi P1 (1.5%). However the prevalence of flacherie and grasserie was reported throughout the year across different seasons.

During commercial crops, farmer's fields are visited, supervised the rearing activities and suggested recommended practices. A total of 584 samples were collected from farmers in different crop seasons, processed and subjected to microscopic examination. The highest grasserie incidence was reported during Shravani (7.5%) and Bhaduri (7.35%) followed by Ashwina crop (5.32%). The highest flacherie incidence was reported in Shravani (3.75%) followed by Jaishta (2.35%). Incidence of Muscardine was reported only in Baisakhi crop (4.48%). Incidence of pebrine was not reported during the year in commercial crops.









In North-Eastern region, during spring crop, average incidence of grasserie was reported as 4.92% and flacherie 1.75%. Highest mortality rate due to Grasserie was reported in Dimapur (16.5%) followed by Agartala (9.83%). Flacherie was reported highest in Koraput (6.50%) and Shillong (3.5%). Incidence of muscardine was reported only at Imphal.

During autumn crop, highest grasserie incidence was reported in Kalimpong (15.01%) followed by Dimapur (8.15%). Highest flacherie incidence was reported in Kalimpong (7.25%) followed by Mangladoi

(3.88%). The incidence of muscardine was reported only at Imphal (1.05%). However the incidences of pebrine were not reported during the year.

With regard to the routine programme, preventive/remedial measures and recommended practices to minimize/control the crop losses due to different silkworm diseases were regularly suggested by the visiting officials to the stakeholders for the effective management of diseases.

CAPACITY BUILDING & TRAINING

Dr. Parameswaranaik, J., Scientist-C

Systematic training was imparted to the stakeholders on different activities of sericulture along with practical demonstrations and hands-on training programmes. A structured course, 15-months Post Graduate Diploma in Sericulture (PGDS) is offered to the participants across the country under affiliation to Kalyani University (Kalyani, West Bengal). A total of 3575 candidates were trained against the target of 2000 through PGDS, FST, TOP, STEP, TTP, EDP, SRC, exposure visits, & need based training programmes etc. Coordination of Seri Resource Centers (SRCs; 6 Nos in West Bengal & Bihar) established to train farmers under Silk Samagra were undertaken.

MOT02016EF: Seri-Entrepreneurship Development in Aspirational Districts of North-Eastern India (DBT funded).

[February, 2022 to January, 2024]

Parameswaranaik, J. (PI), Shafi Afroz, Narayana Biswas (till 31st Jan., 2023), Somen Singh, Swarup Ratan Saha and Amang Mangte Kom.

Objectives:

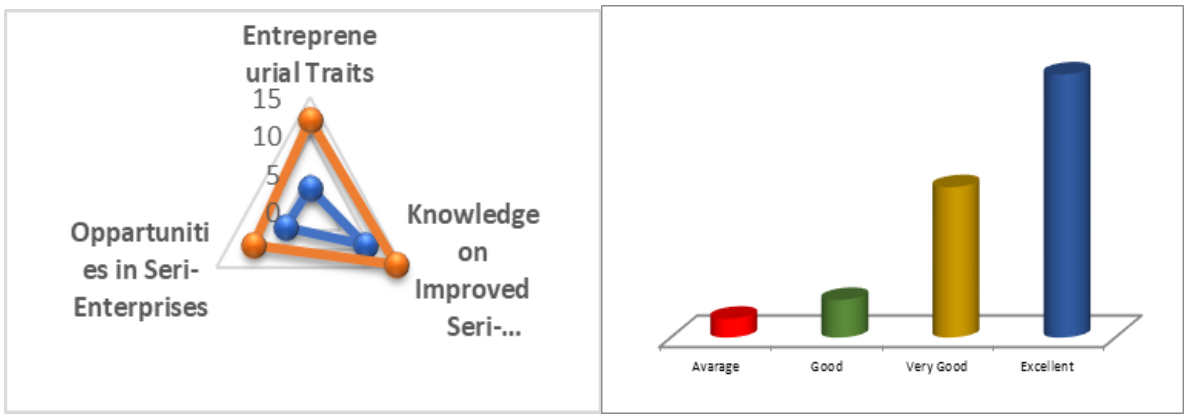
- Promotion of 100 Seri-Enterprises in Aspirational Districts of N-E India.
- Assessment of Socio-Economic Benefits of Developed Seri-Enterprises.

Progress:

The baseline survey has been conducted in association with state sericulture departments officials (Manipur and Tripura) and officers/officials of nested units of Central Silk Board (RSRS-Imphal, Manipur and REC-Agartala, Tripura) for selection of beneficiaries in study area. Accordingly, a total of 100 young women seri-farmers (50 from each selected aspirational district: Dhalai district from Tripura and Chandel district from Manipur) have been selected as beneficiaries for the project.

A semi-structured interview schedule has been developed in consultation with experts and thorough review of literature for collection of base data from the beneficiaries' e.g. socio-economic profile, status of mulberry sericulture farming and entrepreneurial characteristics. Collected data were tabulated and analyzed using suitable statistical tools. The Entrepreneurship Development Programmes (EDPs) have been organized in collaboration with the Department of Handloom, Handicrafts, and Sericulture-Tripura and the Department of Sericulture-Manipur in September, 2022 (from 05.09.2022 to 30.09.2022). Total four numbers of EDPs have been organized for inculcating the entrepreneurial traits and to enhance the knowledge on improved sericulture farming practices.

In order to uplift traditional sericulture farming into commercial sericulture farming an initial handholding support has been provided with procurement and distribution of technological inputs like high-yielding mulberry variety (C-2038), disinfectants, chawki rearing kit, plastic collapsible mountages, shelf-rearing racks and improved reeling units.



Summary of Pre-test and Post-test results of EDP training programme of all beneficiaries and Feedback of participants.

The supply of high yielding mulberry variety (C-2038) saplings and cuttings to beneficiaries is under progress. During the year 45,000 saplings and 26,000 cuttings have been distributed among the 78 beneficiaries. The plastic collapsible mountages (50/ beneficiary), shelf rearing rack (01 /beneficiary), chawki rearing kit (Incubation frame, paraffin paper and foam pad) and disinfectants (5 kg/ beneficiary) have been distributed to all the beneficiaries in study area. The supply of 04 unit of improved reeling unit (motorized charaka with water heating geyser) is under progress

Target and achievement of deliverable set for the 1st year:

Sl. No.	Milestones	Target	Achievement
1	No. of hands-on training/ workshop/ awareness conducted	4	4
2	Total no. of beneficiaries trained/ attended workshops	100	100
3	No. of technologies/ interventions demonstrated	07	08
4	No. of technological interventions introduced for application	07	06
5	Providing training and demonstration to the beneficiaries for utilization of technologies to Women/ SC/ST	100	100

PGDS in Mulberry Sericulture

I Semester (6months; 200 h theory + 200 h practical)	PGD 101: Introductory Sericulture and Mulberry Production PGD102 : Crop Protection PGD103 : Cocoon Poduction PGD104 : Silkworm Breeding, Genetics And Seed production PGD105 :Mulberry production (Practical) PGD 106 :Mulberry crop protection (Practical) PGD107 :Cocoon production (Practical) PGD108 :Cocoon crop protection & silkworm breeding and genetics (Practical)
II Semester (6 months; 200 h theory + 100 h practical)	PGD201:Mulberry Breeding,genetics & physiology PGD202:Post cocoon technology and by product development PGD203:Extension management and seri anagement PGD204:Computer, economics and statistics PGD 205: Mulberry breeding, genetics & physiology & computer, economics & statistics (practical) PGD 206:Silkworm seed production and post cocoon technology(practical)
Dissertation/ Project works (3 months)	Various Disciplines

The PGDS course includes two semesters and dissertation work with well-planned and comprehensive syllabus covering all aspects of mulberry sericulture in coordination with Kalyani University. It also includes 15-day exposure visit in each semester to major mulberry & non-mulberry sericulture areas. Majority of the students are sponsored by DoSs of respective state Governments and few self-funded individuals. The students are taught by experienced scientific personnel working at CSRTI-Berhampore, CSB units and honorary faculties from reputed institutions. The students are evaluated through semester-end examinations including theory and practicals. Students undertake dissertation / practical course work for three months under the supervision of experienced faculty in various disciplines. The students need to submit a dissertation/report, which is evaluated by a set of examiners nominated by the Kalyani University. Those who successfully complete the course are awarded PGDS. Top three students are also felicitated by Central Silk Board (Bangalore) by conferring Gold, Silver & Bronze medals, besides Rs. 15,000 cash award provision to the toppers.

PGDS Admissions (2021-22 & 22-23)		
State	2021-2022 Batch (16)	2022-2023 Batch (24)
Arunachal Pradesh	01	01
Assam	08	04
Manipur	-	10
Mizoram	-	04
Nagaland	06	05
Jharkhand	01	-

PGDS Dissertation Studies (2021-22)			
#	**Student**	**Title**	**Supervisor**
1	Kumtsu Lims	Marker assisted screening of mulberry silkworm for resistance against bidensovirus(BmBDV)	Dr. Pooja Makwana
2	Kano Lego	A study on the performance of seed crop (Nistari: Multivoltine) of West Bengal.	Dr. S. Chakraborty
3	Akash Jyoti Das	Analysis on marketing of mulberry raw silk in Assam state.	Dr. Parameswaranaik J
4	Aishwarya Rani Chetia	Extraction of chitosan from silkworm pupae and egg shells.	Dr. Mihir Rabha
5	Sumitra Boro	Gender roles in Sericulture	Dr. Parameswaranaik J
6	Lebatsonuo Solo	Commercial chowki Rearing Centre in Murshidabad District: Economics and Challenges- A case study.	Dr. Shafi Afroz
7	Chungsunungla l Chang	Effect of Exogenous application of plant hormones and bioactive substance on mulberry leaf longevity	Dr. Deepika K. U.
8	Md Akib Hussain	Identification of Bivoltine breeds tolerant to high temperature and humidity using marker assisted selection in silkworm *Bombyx Mori.*	Dr. Raviraj V. S.
9	Anu Sonowal	Gene Expression profiling of few genes associated with high temperature tolerance in developmental stages of silkworm *Bombyx Mori.*	Dr. Raviraj V. S.
10	Mijingthi Goyari	Antibacterial activity of synthetic antimicrobial peptides against bacteria causing flacherie disease in Silkworm *Bombyx Mori*.	Dr. Pooja Makwana
11	Samuel Nchang	Selection an important tool for Silkworm breeding.	Dr. Th. Ranjita Devi
12	Bhargav Changmai	Characterization of polycross hybrids of mulberry for leaf yield and quality traits.	Dr. Yallappa Harijan
13	Suprita Kemprai	Analysis of heterosis on cocoon yield contributing traits in few improved crossbreeds of silkworm, Bombyx Mori.	Dr. N.Chandrakantha
14	Opangmenla longchar	Nutrient use efficiency of C-2038 in relation to different spacing and fertilizer doses in mulberry.	Dr. Deepika K. U.
15	Zhazo Kire	Field efficacy of chrysoperla zastrowi sillemi against mulberry whitefly Dialeuropora decempuncta (Homoptera : Aleyrodidae)	Mr. Khasru Alam
16	Suganti Chik Baraik	Characterization of mulberry varieties for dus descriptors and tolerance to low nitrogen stress.	Dr. Suresh K.

Farmers Skill Training (FST): The objective of Farmers' Skill Training programme is to enhance the knowledge of sericulture farmers through theoretical and practical training, whivh assist them to improve the income levels. FST duration is of 5-10 days and **421** farmers were trained on various aspects of mulberry cultivation, chawki and late age silkworm rearing etc. FST programmes were also organized in nested units of the institute REC-Dimapur (Nagaland), REC-Mothabari (W.B), REC-Agartala (Tripura), RSRS-Jorhat (Assam) and RSRS-Koraput (odhisa) for the benefit of eastern and north-eastern farmers.

Technology Orientation Programme (TOP): Technology Orientation Programmes were organised with duration of 1-3 days. These programmes were aim to upgrade the knowledge of officers/ officials from CSB/ DoS to the recent technologies developed by the Institute. The main purpose of TOPs is to promote the silk enterprise to achieve the set targets in different states. A total of **51** personnel were trained under Faculty Development Training Programme and Competency Enhancement training for STAs in various disciplines.

Seri Resource Centre (SRC): SRCs established under Silk Samagra in West Bengal and Bihar aims to impart basic training on different aspects of sericultural technologies developed by CSRTI-BHP. These programmes were conducted by the SRC owner (lead farmer) in the village in co-ordination with DoS/ CSRTI-BHP for the benefit of other seri-farmers. A total of **800** farmers (40 batches @ 20 farmers per batch/year) were covered at the six SRCs.

SRC	District/ State	SRC Owner	Contact
Bankipur	Murshidabad	Anisur Rahaman	7407979087
Mollikpur		Md Rejaul Seikh	9735403222
Alinagar	Malda	Md Sufian Ali	9734016330
B. Hazitola		Md. Kased Ali	9734046100
Barbakpur	Nadia	Md K. Seikh	7872870731
Panishal	Kissanganj	Md Lukman Ali	8768925133

Trainers' Training Programme: According to the MoU with ICAR and CSB, this institute arranged for five (5) days Trainers' Training Programme for the ICAR-KVK scientists of various states of E & NE India to update sericultural technologies for further dissemination at field level. A total **10** (ten) scientists from various state undergone the training in different aspects of sericultural activities from the faculty members /experts of this Institute. The Programme was organized by RSRS-Jorhat, Assam.

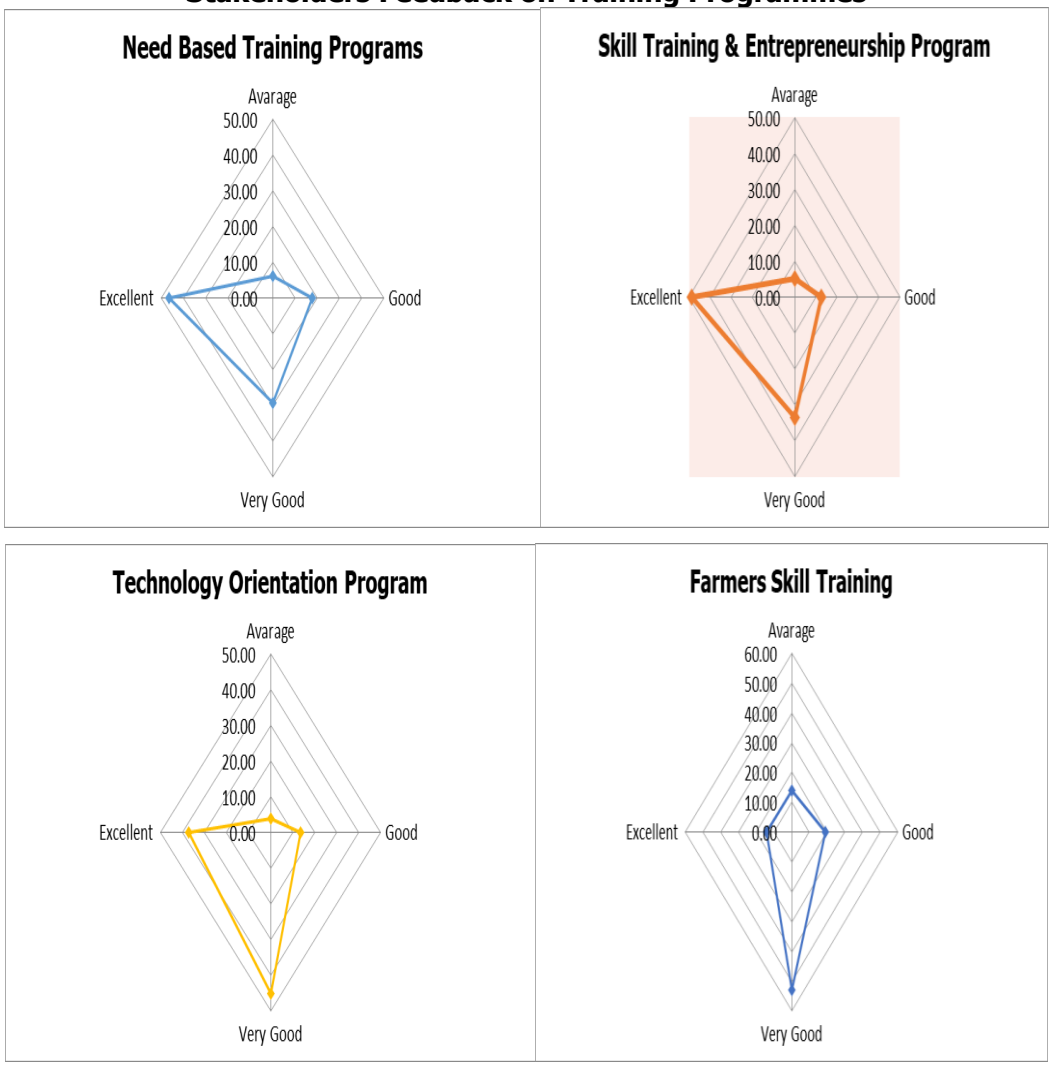
Training for the women farmers under STEP: The institute has organized Skill Training and Entrepreneurship Programme (STEP) for women seri-farmers of Nadia, West Bengal. Different activities of mulberry were imparted through theoritical and practical sessions in three days programme by the scientists and expert technical officials. Total 39 nos trainees benefitted from the training programme.

Exposure Visits: Exposure visits (1-3 days) to best practicising areas with an aim to impart innovative knowledge on mulberry sericulture and latest technologies to the farmers/students of different states. A total of **283** trainees from CBT programmes and **758** trainees from Non-CBT programmes had undertaken the exposure visit programme. The exposure visits were also organized at nested units of the institute (REC-Agartala, REC-Mangaldai, REC-Mamring, REC-Mothabari, REC-Dimapur, RSRS-Jorhat and RSRS-Koraput).

Need Based Training Programmes: This 5-7 days training has been organized as per demand of various state for imparting training on latest technologies in mulberry to the farmers/ officers/officials/ students *etc.* on payment basis (Non-CBT). A total of 1189 personnel were trained in 36 batches. Under

this training an introductory training on mulberry sercilture were organized for Uttar Pradesh sericulture farmers in 14 batches where 599 farmers got benefitted from the programme.

Stakeholders Feedback on Training Programmes



Special Activities on Women Empowerment & Development of SC/ST/Weaker Sections

Prog.	Male					Female					Grand Total
	SC	ST	OBC	Gen.	Total	SC	ST	OBC	Gen	Total	
PGDS (2022--23)	1	9	3	2	15	-	4	2	3	9	24
FST	62	21	67	76	226	47	28	59	61	195	421
TOP	5	-	3	34	42	-	-	-	9	9	51
TTP	-	-	-	6	6	-	-	-	4	4	10
STEP	1	-	1	1	3	10	-	13	13	36	39
EXPO.VISIT	39	21	25	29	114	74	26	40	29	169	283
SRC	81	11	214	126	432	112	12	127	117	368	800
NBT (Training)	153	46	332	408	939	73	52	42	83	250	1189
NBT (Expo visit)	41	19	79	156	295	69	-	206	188	463	758
Total	**383**	**127**	**724**	**838**	**2072**	**385**	**122**	**489**	**507**	**1503**	**3575**

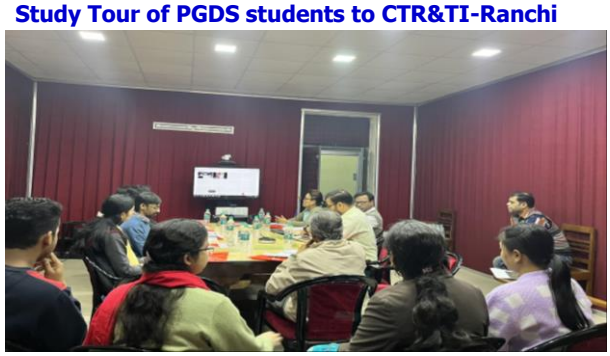
PHOTOGRAPHS OF CBT PROGRAMMES

Farmers Skill Training Programme

Inaguration of Trainers Training Prog.

Study Tour of PGDS students to CTR&TI-Ranchi

Exposure visit of farmers



Faculty Development Training programme

Hands on Training for Farmers

EDP programme

Interstate training programme was organized for the farmers of Uttar Pradesh from 8.8.22 to 12.08.22

SERICULTURAL EXTENSION ECONOMICS AND MANAGEMENT (SEEM)

Dr. G. Srinivasa, Scientist-D & Dr. Shafi Afroz, Scientist-C

SEEM Division takes scientific information to the sericulturists and also brings the problems of the sericulturists to the institute for the solutions continuously in which both the scientist and the farmer contribute and receive. Thus, CSR&TI will assist people engaged in farming and home-making to utilise their resources and those available to them in solving current problems and in meeting changing economic & social conditions. The RSRSs and RECs working at the grassroots play a crucial role in bridging the scientists at the main institute and farmers for exchange of technology transfer and field problems respectively. These stations/centres apart from transferring technical know-how are also involved in validating the new technology generated by the institute before recommending it to the farmers. The problems transfer to the research institute through these units assist in formulating new research projects by the scientists and also in modification of the technology if need be. The CSRTI Berhampore has 3 Regional Research Stations and 8 Research Extension Centres attached to carry out research extension activities throughout the eastern and northeastern states of the country.

On-going Research Projects

MOE02011EF: Development of Seri-Entrepreneurship through sericulture chawki business by setting up 02 Chawki Rearing Centers (CRC) as demonstrative units in Murshidabad district, West Bengal.

[April, 2021 to March, 2024]

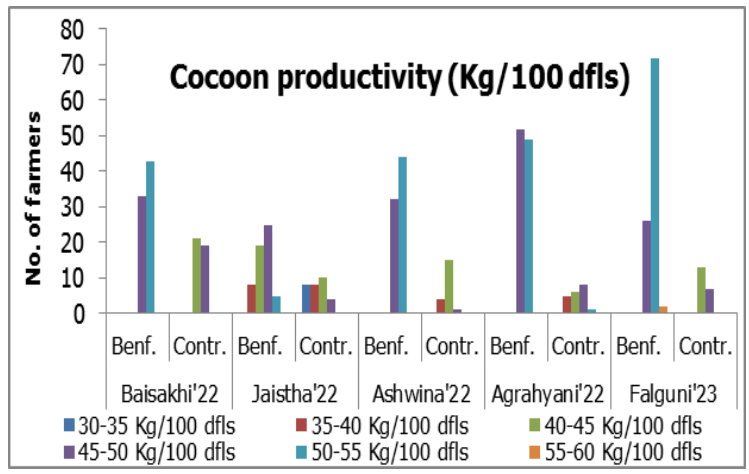
Shafi Afroz, Parameshwar Naik, J., Manjunatha G.R., Srinivasa, G. and Dipesh Pandit

Objectives:

- To initiate chawki seri-business in sericulture villages of Murshidabad district.
- To assess the impact of chawki seri-business on the economic condition of the farmers.

Two CRCs were established as demonstration units in Murshidabad with a brushing capacity of 5000 silkworm layings per batch. During 2022-23, as per the crop schedule, 5 crops were successfully brushed and worms were distributed by both the CRCs.

During the first year of the project, the CRC concept was introduced to the farmers and those who reared chawki worms in place of direct was found happy as they could harvest successful crops with higher yield and income levels. Further, awareness programmes as well as group discussions, were organized and hence those who were not using chawki worms were motivated further to rear chawki worms for higher cocoon quality, yield and income. During 2022-23, 10 awareness programmes were organized in villages of Murshidabad to encourage farmers to use chawki-reared silkworms in place of direct brushing. With the financial support from NABARD, the earmarked



equipment and machines to rear 5000 dfls chawki were supplied to both CRCs. Since the beginning, 61100 dfls of N× (SK6×SK7) silkworm hybrids were brushed during 07 chawki crops. During 2022-23, a total of 45100 dfls were brushed in 05 chawki crops at both the CRCs and sold to 454 farmers in the range of 50-150 dfls for late age rearing. The average cocoon productivity was 49.11 kg/100 dfls for the beneficiary farmers while it was 42.98 kg/100 dfls for their counterparts; hence there is a gain of 14.3% in cocoon yield per 100 dfls by use of chawki worms. The average price of cocoon was worked out to be ₹401.40/ kg for beneficiary farmers while it was ₹383.00 per kg for control farmers.

The concept of commercial CRC is very essential for the development of the silk industry in West Bengal. Two technical workshops for chawki rearing with different stakeholders of West Bengal were organized in Murshidabad and Malda districts. A total of 214 stakeholders participated in the workshop. An exposure visit for 25 sericulture farmers of Murshidabad to Mysore and other sericulture areas of Karnataka for creating awareness regarding commercial CRC and the latest technologies of sericulture was arranged under the project with the funding support of NABARD RO-West Bengal, Kolkata.

MTS13002MI: Impact Assessment of Mulberry Sericulture Technologies in India.

[July, 2022 to June, 2025]

Shafi Afroz, Sci-C (CSRTI-Berhampore, Co-PI); Manjunatha, G. R., Sci-C (Co-PI); Naveen Padaki, Sci-D (CSTRI, Bangalore, Co-PI); Muthulakshmi M, Sci-D (CSRTI, Mysore, Co-PI); Satish Y, Sci-C (CSRTI, Pampore, Co-PI); S. Nazeer Ahmed Saheb, Sci-D (Co-Cl); Halagunde Gowda GR, Sci-C (Co-Cl)

Objectives:

- To create a protocol for maintaining the data-base of technologies developed by CSB R&D institutes and enlisting all the technological interventions along with the expected impact.
- To understand the socio-economic aspects of the impact of sericulture technologies on seri-farmers' livelihoods from different regions.
- To work out comparative economics of sericulture vis-a-vis other commercial agricultural & horticultural enterprises in select regions.

Developing technologies and their transfer to grass root level stakeholders is a continuous process. At the same time, it is quite important to understand the efficacy and impact on socio-economic and environmental parameters at regular intervals which occurred as a result of technology adoption at the farmers' field.

To understand the impact of technologies, crop-wise data is being collected from different villages of Eastern and North-Eastern India. Till date, a total of 245 beneficiaries' information (rearers and reelers) collected from 8 villages of Murshidabad, Nadia and Birbhum districts of West Bengal.

Extension Communication Programmes (ECP)

CSRTI-Berhampore is organizing various Extension Communication Programmes in different parts of West Bengal. In addition, it is also coordinating in organizing programmes through nested units of the Institute situated in different Eastern and North-Eastern states. These units are also involved in carrying

out need-based extension activities for technology transfer in mulberry and silkworm crop production, crop protection and post-cocoon activity in the states of their location. Details of ECPs conducted by CSRTI-Berhampore and its nested units e.g. RSRSs & RECs located in different states are as follows:

ECP carried out during the year in different states are provided below.

State	Unit	AP		FFD		TD		WSE		Total (No.)	
		E	F	E	F	E	F	E	F	E	F
West Bengal	CSRTI-BHP	5	412	5	400	2	40	2	414	15	1757
	RSRS-Kalimpong	2	99	5	245	3	54			11	568
	REC-Mothabari	7	700			7	165	1	100	15	965
Jharkhand	REC-Bhandra	3	165			3	72			6	237
Odisha	RSRS-Koraput	2	112	5	300	2	49			10	665
Assam	RSRS-Jorhat	2	138	6	476	1	53	1	111	11	991
incl. BTC	REC-Mangaldoi	5	282			5	112			10	394
Sikkim	REC-Mamring	3	162			3	76			6	238
Mizoram	REC-Aizwal	3	150			4	80			7	230
Tripura	REC-Agartala	5	251			5	100			10	351
Meghalaya	REC-Shillong	4	261			5	110			9	371
Nagaland	REC-Dimapur	4	358			3	70			7	428
Ar. Pradesh	REC-Sille	2	186			2	41			4	227
Total		**47**	**3276**	**21**	**1421**	**45**	**1022**	**4**	**625**	**117**	**6344**

Note: E: Events; F: Farmers; AP: Awareness prog.; FFD: Farmers' Field day; TD: Technology demos; WSE: Workshop/ Expo

Resham Krishi Mela (RKM)

The strength of a new variety/technology over the existing/traditional will be demonstrated to the large group of farmers through Krishimelas. During the programme, the farmers were invited to visit the station and visualize the benefit of new technology over the existing.


RKM at Berhampore, West Bengal


RKM at RSRS, Jorhat, Assam

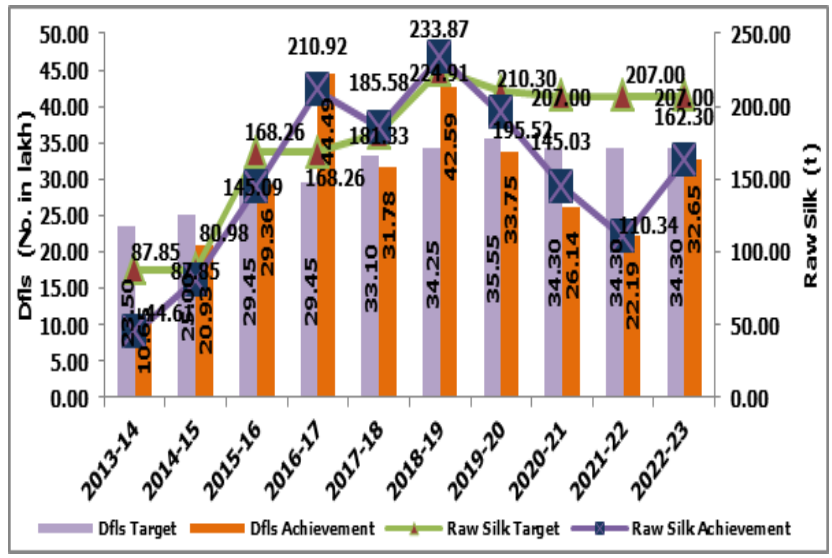
RKM at RSRS, Koraput, Odisha


RKM at RSRS, Kalimpong (Organised at Namchi, Sikkim)

In this regard, 04 Resham Krishi Melas were organized in E and NE regions, one each at Murshidabad (West Bengal), Jorhat (Assam), Mamring (Sikkim) and Koraput (Odisha) by CSRTI-Berhampore, RSRS-Jorhat, RSRS-Kalimpong and RSRS-Koraput respectively. A total of 1078 farmers and other stakeholders were benefitted from the mela. Important technologies were also exhibited to the farmers during the mela by way of organizing a small technology exhibition**.**

Cluster Promotion Programme (CPP) in East & North-East India

Central Silk Board in association with the Department of Sericulture in various states has introduced the concept of the Cluster Promotion Programme with an ambitious plan of producing bivoltine raw silk. The Institute administered 8 mega clusters through its nested units in 6 Eastern and North Eastern states (West Bengal-2; Assam & Nagaland-2; Manipur-2; one each in Mizoram & Tripura). Accordingly, a group of villages were selected by each of the Cluster Development Facilitator (CDF) based on the potentiality of the area for practising bivoltine sericulture. Various improved technologies were introduced in the cluster villages and were managed and supervised directly by the scientists jointly with the DoS counterpart, especially with the cooperation and participation of farmers. Under each of these clusters, farmers were facilitated for bivoltine technology adoption with an effective Research-Extension-Farmer linkage. As a result, the cocoon productivity levels in the cluster area and thereby the income has increased at the farmer's level.



State and cluster wise list of Cluster Development Facilitators in E & NE clusters

Mega Clusters	CSB	DoS
West Bengal		
Malda	Boya Vijaya Naidu, Sci-D, REC-Mothabari; *recmothabari@gmail.com*; 9441984340 Dr. S.N. Bagchi, Sci-D, SSPC- BHP bagchisnb5@gmail.com, 8900383227	Smt Usha Das, DD(S)[I/C], Malda; *malseri2@gmail.com;* Dr. T. Mukherjee, DD(T)[I/C], Birbhum; *birseri@gmail.com*; 8250893776
Murshidabad	Dr. Srinivasa G., Sci-D, CSRTI-Berhampore; *extn.csrtiber@gmail.com; bvcell.csrti@gmail.com*; 9907547467	Shri S. Chowdhury, DD [I/C], BHP; *berseri1@gmail.com*; 86172 24647 Mr. Supratim Das, AD(T), Nadia; *nadiseri@gmail.com*; 98301 05014
Assam & Nagaland		
Assam-Lower	Dr. B. K. Basumatary, Sci-D, REC-Darrang, *basumatary.bene@yahoo.com*; 9435304453	Mr. Jagesh C. Talukder, ADS-Mangaldoi, *adsofficemld@gmail.com*; 9101407835 Shri Anjan Kumar Chakraborty, AD(Seri)-Udalgiri; 9435181586
Assam-Upper	Mrs Junumoni Das, STA, RSRS-Jorhat; *rsrsjor.cdsb@nic.in;* 8876668773 Shri Intimokchung, STA, REC-Dimapur; *recdimapur.nagaland@gmail.com*; 9436430311	Mrs Dipanjali Das, ADS-Jorhat; 9706067884; Shri Meyase, DSO-Dimapur;7005527030

Manipur		
Manipur-Plain	Dr. L. Somen Singh, Sci-D, RTRS-Imphal; *somenlaishram@yahoo.com*;9612021635	Ms Js Ngalangaml, AD-Ukhrul; *ngalangamjajo@gmail.com*; 7628019930
Manipur-Hill		Ms Lalnunthar, AD-Churachandpur; *mangtovang@gmail.com*; 8413853111
Mizoram		
Aizawl	Dr. Dip Kumar Gogoi, Sci-D, REC-Aizawl; *recaizawl2017@gmail.com*; 9957034432	Shri V. Zothansanga, District Sericulture Officer, Aizawl, *dsoproject@gmail.com*, 878752415
Tripura		
West Tripura	Shri Salam Bijoy Meitei, STA,REC-Agartala; *sgbcrsti@rediffmail.com*; 9615179959	Shri Sanjit Debbarma, Supritendent; *sanjitspurty2014@gmail.com*; 7005710950

Performance of clusters: The 08 Mega clusters of the Eastern & North Eastern zone have produced 1398.31 MT of cocoons and recorded 162.31 MT (78.41%) of raw silk production (BV: 75.63 MT & ICB: 86.68 MT) against the target of 207 MT; which was 51.97 MT more as compared to the previous year (2021-22). During 2022-23, a total of 32.65 Lakh dfls (BV: 13.67 & ICB: 18.98) were reared against the target of 34.30 Lakh dfls (BV: 26.30 & ICB: 8.00) with an achievement of 95.19%. The graphical representation of the performance of clusters in the last ten years is indicated in the figure.

Performance of Improved Cross Breed (ICB) under CPP in East & North East Zone

ICB Raw Silk Production in East & North East Zone (2022-23)

Mega Cluster	Dfls(Lakh)		Cocoon Production(MT)	Yield/ 100 dfls(kg)	Raw Silk (MT)		
	Target	Ach.			Target	Ach.	% Ach.
West Bengal							
Malda	4.0	8.375	367.918	43.93	16.0	36.792	229.95
Murshidabad	4.0	8.807	390.322	44.32	16.0	43.195	270.97
Tripura							
West Tripura	--	1.800	60.200	43.00	--	6.690	--
Total/Avg.	**8.0**	**18.982**	**818.44**	**43.75**	**32.0**	**86.667**	**250.46**

Performance of Bivoltine hybrids under CPP in East & North East zone

Bivoltine Raw Silk Production in East & North East zone (2022-23)

Mega Cluster	Dfls (Lakh)		Cocoon Production(MT)	Yield/ 100 dfls(kg)	Raw Silk (MT)		
	Tar.	Ach.			Tar.	Ach.	% Ach.
West Bengal							
Malda	3.5	3.202	122.960	38.40	28.4	17.565	61.85
Murshidabad	3.25	2.138	113.114	52.91	26.60	16.195	60.75
Manipur							
Manipur-Plain	2.75	2.015	78.16	38.79	17.50	9.620	54.97
Manipur-Hill	2.75	2.035	81.02	39.32	17.50	10.05	57.43
Assam & Nagaland							
Assam-Lower	4.5	0.956	43.505	45.51	30.0	5.40	18.00
Assam-Upper	4.25	0.4078	6.217	21.44	24.0	0.696	2.90
Mizoram							
Aizawl	2.80	2.3	109.69	47.69	16.0	13.140	82.13
Tripura							
West Tripura	2.5	0.616	25.20	42.00	15.00	2.96	19.73
Total/Avg	**26.3**	**13.760**	**579.866**	**40.76**	**175.0**	**75.626**	**44.72**

Silkworm hybrids distributed under CPP in E & NE zone

State / Mega Cluster	Bivoltine	ICB
West Bengal (Malda & Murshidabad)	SK6×SK7 /BHP-DH / TT21xTT56	12YxBFC1 / N×(SK6×SK7)
Assam & Nagaland (Assam-Lower & Assam-Upper)	SK-hybrids Double hybrids	
Manipur (Plain & Hill)	FC1×FC2 / C×J / CSR2×CSR4/SK-hybrids	
Mizoram (Aizawl)	SK-hybrids / J112	
Tripura (West)	FC1×FC2 / SK-hybrids	12YxBFC1/PM×FC2 / M6DPC×(SK6×SK7)/ N×(SK6×SK7)

Multimedia Activities (2022-23)

Units	Topics	Language & Channel
Radio programme		
CSRTI-BHP	Improved of Sericultural technologies by Dr. S. Chakraborty, Sc-D (16.02.23)	Bengali (AIR-MSD)
Facebook programme		
CSRTI-BHP	Resham Krishi Mela telecasted through 15 social media sites	Bengali
RSRS-Kalimpong	Resham Krishi Mela	Nepali
RSRS-Jorhat	Resham Krishi Mela telecasted on local news	Assamese
Twitter @ CsrtiBerhampore		
Instagram @ CSRTIBERHAMPORE		
Facebook @ East North East Silk		
WhatsApp @ CSRTI-Berhampore and Sub-units of CSRTI-Berhampore		

PMCE Division

Dr. Dipesh Pandit, Scintist-D

MOE 020014SI: Popularization of Improved Sericultural Technologies for Eastern and North-Eastern India.

[February, 2022 to January, 2025]

Co-ordinator: Dr. Dipesh Pandit, Scientist-D, PMCE

Execitive Authority: *Dr. Kishor Kumar C.M., Director*

Component-I: Popularization of New Mulberry Varieties (C-2038, Tr-23/BC259 & C-2028)

Suresh, K. (PI), Deepika, K. U. and Incharges RSRSs & RECs

Objectives:

- Popularization of new mulberry varieties among the farmers in E & NE India.
- Impact assessment with regard to cocoon crop productivity.

Progress:

Mulberry Variety Authorization Committee (MVAC) of Central Silk Board recently authorized two high yielding mulberry varieties viz., C2038 & Tr-23 and also recommended for popularization. Further, MVAC (X^{th} meeting) suo-moto authorized two mulberry varieties developed for specific conditions (C2028 for water logged area; C776 for saline soils). Four new mulberry varieites (C2038, Tr-23, C2028, C776) are being popularized and evaualted at on farm in Eastern and North-Eastern India (MVAC -2017). The planting material of new varieties C2038 (35,000), Tr23 (2000), C776 (1000) & BC259 (4,000) are generated at CSRTI Berhampre and also in its nested units. C2038 was established with 85 farmers/ benefeciers (6.80 acres) is in four states with more than 85-90% survival. C2028 was established with 10 farmers in water logged region of Assam with more than 80% survival. The new planatation was also supplied with allocated inputs for proper establishement.

Component-II: Popularization of Bio-Control Agents for the management of mulberry pests

Khasru Alam (PI) and Incharges RSRSs & RECs

Objectives:

- Popularization of bio-control agents at field level for eco-friendly management of thrips and mealy bugs in mulberry.
- Impact assessment with regard to cocoon crop productivity.

Progress:

A total of 1,12,374 *Chrysoperla zastrowi sillemi* eggs were mass produced in laboratory during the year and the same was used for releasing to the different farmers field covering 7 locations in five different states of Eastern and North Eastern India. *Chrysoperla zastrowi sillemi* as biological control agent for management of mulberry thrips was released with 68 farmers field in Murshidabad, 24 farmers field in Nadia, 23 farmers field in Malda, 6 farmers in Koraput, Odisha, 10 farmers in Jorhat Assam, 10 farmers in Agartala, Tripura and 10 farmers in Sikkim which covers approximately 60 acres of area. Average pest population reduction because of introduction of biological control agent in three different villages Balashpur, Sahebnagar and Alinagar of Murshidabad was 44.19, 64.62 and 58.13% respectively when compared with control pest population and the same was 25.82, 41.05 and 19.77% against pre release pest population. In Nadia, the average pest population reduction against control was 79.41% where as the same was 49.15% against pre-release population. In Malda, the average reduction against control was 53.31% and the same was 14.37% against pre release population. In Sikkim, the average pest population reduction was 70.48% against control and 34.39% against pre release population. Population reduction to the tune of 71.54% against control and 46.25% against pre-release population was observed in Agartala. In Jorhat, the average pest population reduction against control was 70.97 % where as the same was 33.08% against pre release population and for Koraput population reduction against control was 64.91% and against pre-release population reduction was 41.41%, respectively.

Effect of Biological control *Chrysoperla* sp against mulberry thrips in E & NE India

Location / Unit	Target	Farmers covered (Nos.)	Avg. Pre- count thrips / leaf	Avg. Control thrips count /leaf	Avg. Reduction over control (%)
Balashpur (MSD)	30	22	8.13	12.75	44.19
Sahebnagar (MSD)		26	5.82	9.85	64.62
Alinagar (MSD)		20	6.03	12.45	64.62
REC-Mothabari	40	23	5.05	9.16	53.31
RSRS-Koraput	10	6	6.83	11.67	64.91
REC-Agartala	10	10	1.13	2.33	71.54
RSRS-Jorhat	10	10	2.52	5.38	70.97
REC-Mamring	10	10	1.85	4.13	70.48
Nadia	20	24	2.12	4.57	79.41
Total	150	151			

Component-III: Popularization of eco-friendly disinfectant, NIRMOOL™

Rabha, M. (PI), Rahul, K. and Incharges RSRSs & RECs

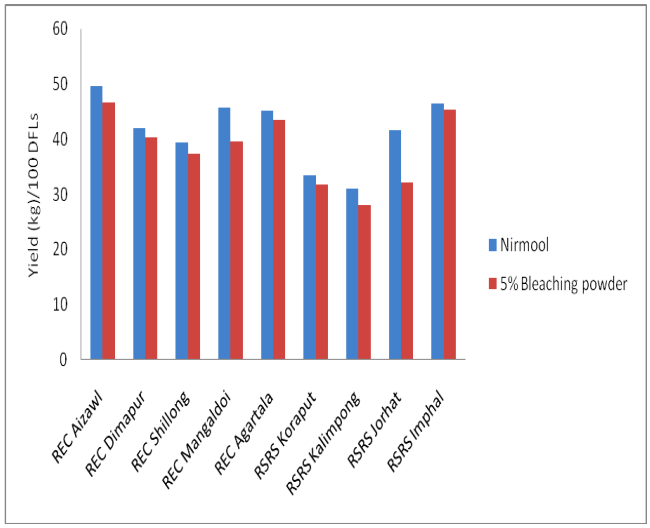
Objectives:

- Popularization of Nirmool, a general disinfectant with sericulture farmers of E & NE India.
- Impact assessment at farmers' level.

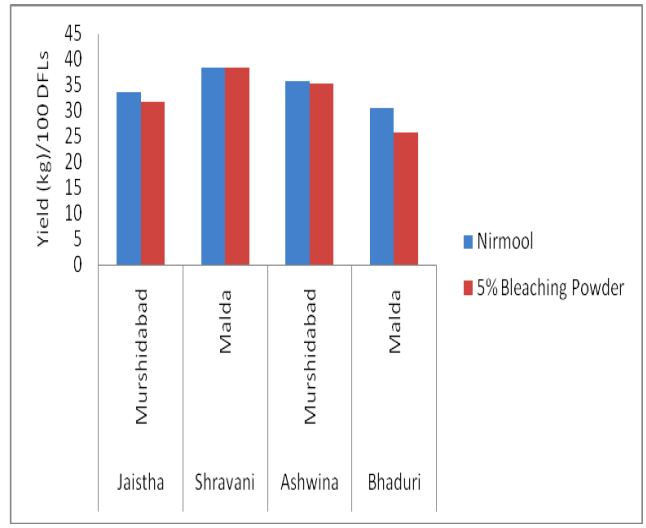
Progress:

- NIRMOOL™ is an eco- and user friendly disinfectant suitable for disinfection of silkworm rearing house and rearing appliances. NIRMOOL™ is non-corrosive, possess higher shelf life and is immediately soluble in water which aids in rapid preparation of disinfectant solution. Nirmool based disinfection is very lucid and the product being cost effective is an added advantage. Disinfection with the existing disinfectant formulations (Bleaching powder, formalin, Chlorine dioxide) will not only damage the infrastructure by corrosion, but also instigate respiratory and dermal hazards to the users. To overcome the disadvantages of these existing room disinfectants NIRMOOL™ was formulated. The validation for the efficacy of NIRMOOL™ was successfully conducted and completed through laboratory trials, in house validation as well as on station trials (OST) in 27 locations of different CSB units (including RSRSs, RECs and Seed farms) of Eastern and North-Eastern states and DoS farms of West Bengal during 2021-2022.
- For popularization of Nirmool, trials were conducted at farmer's level in both Autumn and Spring crops of NE region through different DoS Units, RECs and RSRSs and received promising reports. In North-Eastern states, Nirmool along with Bleaching powder was distributed to 210 farmers including those under RSRS Koraput. An average cocoon yield per 100 dfls was recorded as 41.58 kg for Nirmool users and 38.27 kg for 5% Bleaching powder users (control treatment).
- In West Bengal, NIRMOOL™ was distributed to 980 farmers in four different districts (Birbhum, Nadia, Murshidabd and Malda) across five different crops (favourable and unfavourable seasons). During favourable season's crops in Baisakhi, Agrahayani and Falguni, average cocoon yield per 100 dfls was recorded as 44.88 kg for Nirmool users for Multi x Bi cross and 41.87 kg for 5% Bleaching powder

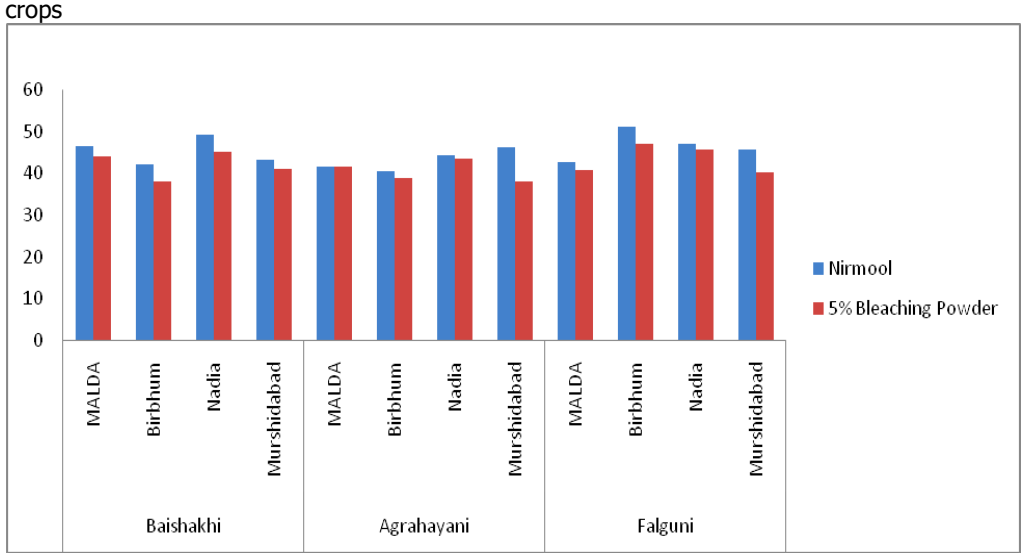
users. During unfavourable season's crops in Jaistha, Shravani, Bhaduri and Ashwina, average cocoon yield per 100 dfls was 34.48 kg for Nirmool users and 32.78 kg for 5% Bleaching powder users. The performance of NIRMOOL™ was found equally effective with that of 5% Bleaching powder across different crops in both favourable and unfavourable seasons.



Efficacy of Nirmool and 5% Bleaching powder solution (as control treatment) in North-Eastern regions during Spring and Autumn crops



Efficacy of Nirmool and 5% Bleaching powder solution (as control) during favourable seasons of West Bengal



Efficacy of Nirmool and 5% Bleaching powder solution (control) during unfavourable seasons of WB

Component-IV: Popularization of Chawki, Shoot/Shelf rearing & Plastic collapsible mountages

Srinivasa, G. (PI), Shafi Afroz and Incharges RSRSs & RECs

Objectives:

- Popularization of proven silkworm cocoon production technologies like Chawki and Shoot feeding/ Shelf rearing and usage of Plastic collapsible mountages among the farmers' in E & NE India.
- Impact assessment on cocoon productivity at farmers' level.

Progress:

Popularization of chawki rearing and collapsible plastic mountages & shoot feeding (shelf rearing) was undertaken by the farmers through nested units of West Bengal, Assam, Odisha, Meghalaya, Mizoram, Tripura and Nagaland.

❖ *Popularization of Chawki Rearing*

Visualising the success of rearing the young age silkworms and distributing the same during the second moult, the Institute is popularizing this concept under the project in E and NE regions. Under the project, 07 CRCs, each with a capacity of 1000 dfls/crop were identified as beneficiaries and supported for 2 crops during 2022-23 in West Bengal (2), Assam BTC (1), Tripura (1), Nagaland (1), Mizoram (1), and Meghalaya (1). The beneficiaries were supplied with 1000 dfls, bed and room disinfectants, paraffin paper, incubation frame, black cloth, foam pad, brushing net and lime to be used in chawki rearing to promote the chawki rearing concept. Apart from this, the CRC owners were provided with an amount of Rs. 6000 per crop as chawki charges. The chawki worms were distributed to the farmers after 2nd moult. The cocoon production per 100 dfls of chawki worms was compared with the cocoon production of direct brushing.

Unit-wise yield and cocoon parameters are provided below:

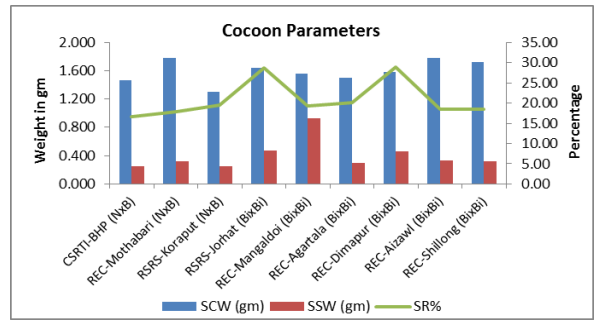
Unit	CRC	Season	Hybrid	Hatch-ing (%)	Larval growth* (g)	Missing larvae (%)	Unequal larvae (%)	Yield/100 dfls (kg)		
								CRC	Direct	Gain (%)
CSRTI-BHP	1	AGR'22 & FAL'23	Nx(SK6.7)	96.5	2.57	1.45	Nil	50.81	47.6	6.74
REC-Mothabari	1		Nx(SK6.7)	95.5	2.23	4.00	1.18	45.48	41.17	10.47
REC-Mangaldoi	1	Autumn'22 & Spring'23	SK Hybrid	92.0	3.32	6.00	5.00	45.27	40.68	11.28
REC-Agartala	1		12Y×BFC1	92.0	2.60	4.50	1.50	44.92	42.97	4.54
REC-Dimapur	1		BHP-DH	84.0	4.05	2.80	0.9	42.04	39.3	6.97
REC-Aizawl	1		SK6.7; BHP-DH	95.5	3.54	3.81	2.64	50.0	45.5	9.89
REC-Shillong	1		SK hybrid	93.0	3.48	4.00	8.00	39.33	38.94	1.00
							Average	45.41	42.31	7.32

*weight of hundred larvae under 2nd moult; AGR-Agrahyani; FAL-Falguni'22

It was observed that the above technolgy has recorded higher cocoon yield in the range of 1.0% to 11.28% under different sub units. The average increased in yield was 7.32% over the control.

❖ *Popularization of Shoot rearing & Plastic collapsible mountages*

As a part of the popularization process, shoot-rearing technology was extended to 140 farmers in West Bengal (Agrhayani' 22 & Falguni' 23 crop), Odisha, Assam BTC, Tripura, Nagaland, Mizoram and Meghalaya during autumn' 22 and spring' 23 crop. For rearing 100 dfls, each of the beneficiaries was assisted with shelf preparation cost @₹8500; bed disinfectant @7kg/crop; lime @7kg/crop; bleaching powder @2kg/crop; bed cleaning net @50nos.; collapsible plastic mountage @50nos. The number of beneficiaries, hybrid reared, season, yield and cocoon parameters recorded under the technology are given below:



Unit	Season	Hybrid	Beneficiary	Avg. Yield (kg/100 dfls)			Reduction in labour			Mkt rate (Rs.)
				Shelf	Dala	Gain (%)	Shelf	Dala	Red (%)	
CSRTI-BHP	AGR'22 & FAL'23	Nx(SK6.7)	25	50.81	47.60	6.73	45	33	36.92	455
REC-Malda		Nx(SK6.7)	30	45.48	41.17	10.46	37	33	12.12	414
RSRS-KPT			10	31.20	25.62	21.78	12	9	33.33	300
RSRS-Jorhat	Autumn'22 & Spring'23	SK6.7	10	40.75	36.87	10.51	39	33	18.18	400
REC-MLI		Sk Hybrid	20	45.27	40.68	11.27	30	20	48.43	300
REC-Agartala		12Y×BFC1	15	44.92	42.97	4.54	18	10	80.00	280
REC-Dimapur		DH-BHP; 12Y×BFC1	10	42.04	39.30	6.97	-	-	-	300
REC-Aizawl		SK6.7; DH-BHP	10	50.00	45.50	9.89	-	-	-	350
REC-Shillong		SK hybrid	10	39.33	38.94	1.00	36	25	44.00	300
Avg.			**140**	**43.31**	**39.85**	**8.68**	**31**	**23**	**33.03**	

[RSR-KPT: RSRS-Koraput; REC-MLI: REC-Mangaldoi; AGR-Agrahayani; FAL-Falguni'22]

The average cocoon yield obtained through shoot rearing was found to be 43.31 kg/100 dfls as compared to tray rearing (39.85 kg/100 dfls) registering an overall increase of 8.68% in yield. Further, it was observed that there is a reduction of 33% in labour requirement as compared to tray rearing.

Component-V: Popularization of Sampoorna

M. Rabha (PI), K. Rahul, L Somen Singh (RSRS-Imphal) and Incharges RSRSs & RECs.

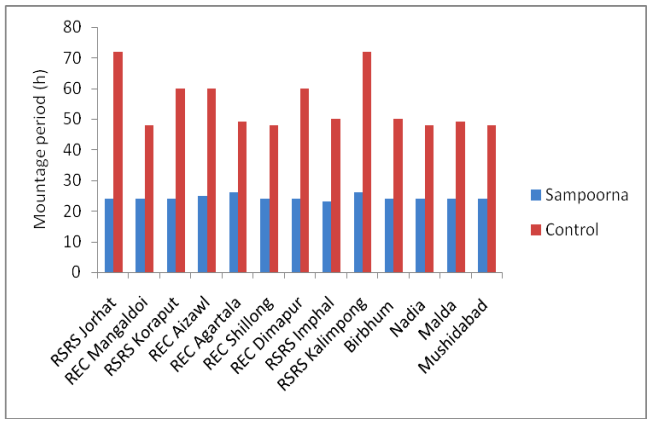
Objectives:

- Popularization of Sampoorna, a phytoecdysteroid formulation in E & NE India.
- Impact assessment of Sampoorna on cocoon productivity at farmers' level.

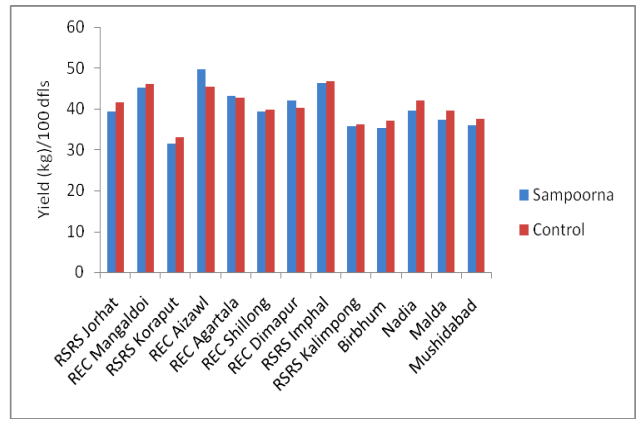
Progress:

'Sampoorna' is a phytoecdysteroid formulation developed by CSRTI-Mysore that induces uniform larval maturation leading to synchronization of spinning process. Sampoorna helps in reducing crop losses due to non-uniform maturation, delayed spinning especially during winter months and non-spinning syndrome. Application of Sampoorna also saves time, labor and mulberry leaf. In this regard, Sampoorna is a proven technology and might play a vital role to alleviate the current challenges. The study was undertaken to analyze the impact of Sampoorna on uniform larval maturity and cocoon productivity at farmer's level.

As per the schedule during the year, Sampoorna has been dispatched to 11 locations (RECs and RSRSs) of North Eastern states in order to cover 340 farmers during the Spring and Autumn crops. In West Bengal, Sampoorna was distributed during three crops as per schedule (Agrahayani, Falguni & Baishakhi) to 750 farmers. Application of Sampoorna induced uniform larval maturity and initiated spinning. Sampoorna treatment to V instar larvae on 7^{th} & 8^{th} day induced spinning within 24h of treatment. It reduced mountage period from 48 h to 24-30 h resulted in successful cocoon formation and prevented crop loss. The yield was found at par with the normally matured larvae in all crops of E & NE states.



Application of Sampoorna reduced mounting duration at different locations of E & NE



Effect of Sampoorna on average cocoon yield at different locations of E & NE

REGIONAL SERICULTURAL RESEARCH STATIONS (RSRSs) AND REGIONAL EXTENSION CENTERS (RECs)

RSRSs are established to address the regional problems of sericulturists through research & extension support in varied agro-climatic regions. Apart from that RSRS undertake validation of new technologies develoed by the institute. The proven technologies are transferred further to the field through Research Extension Centres (RECs). CSRTI-Berhampore has three RSRSs viz., RSRS-Kalimpong covering hilly districts of West Bengal & Sikkim state, RSRS-Koraput (Odisha) covering Odisha state and RSRS-Jorhat (Assam) covering North Eastern states. The main institute coordinates all the R&D, Extension and Capacity building programmes in the command states.

Mandate of the RSRSs:

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

Mandate of the RECs:

- ❖ Frontline demonstration of technologies through selected farmers in coordination with DoS.
- ❖ Resource centre for critical inputs & seri-appliances such as mulberry cuttings, silkworm seed, chemicals, etc.
- ❖ Conduct farmers' training on various technology.
- ❖ Coordination with Dept. 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.

Manpower of RSRSs & Nested RECs

The staff strength and the incharge officers who are toiling in the above activities in the field under Regional Sericuture Research Stationas and Research Extension Centres attached to the Institute are provided in the table below.

State	Unit	Name of Scientists/Incharge	Tech. Staff/ Fld. Asst. (No.)	TSFW/ SFW (No.)	Farm based units	
					Total Acreage	Mulberry Acreage
West Bengal	RSRS-Kalimpong	Dr Harish Babu S., Sci-C	6	17	15.785	3.75
	REC-Mothabari	Dr B Vijaya Naidu, Sci-D	4	5	3.89	2.75
Jharkhand	REC-Bhandra	Shri Shankar Rai (STA)	2	13	11.35	5.65
Odisha	RSRS-Koraput	Smt Padmavati Raju (STA)	7	21	50.00	7.60
Assam incl. BTC	RSRS-Jorhat	Smt Junumoni Das (STA)	4	18	12.10	7.50
	REC-Mangaldoi	Shri Ujjal Kanti Paul (STA)	2	1	7.00	5.50
Sikkim	REC-Mamring	Shri Bhanu shilal (STA)	3	-	-	-
Mizoram	REC-Aizawl	Dr. N. Shaktivel, Sci-D (upto 18.03.23)	1	-	-	-
Tripura	REC-Agartala	Shri Salam B Meitei (STA)	3	2	1.50	0.50
Meghalaya	REC-Shillong	Shri Dwijen C Das (STA)	2	1	-	-
Nagaland	REC-Dimapur	Shri Intimokchung (STA)	4	4	10.00	8.50

RSRS KALIMPONG:

RSRS-Kalimpong is situated at an elevation of 3550 feet above MSL in the sub-Himalayan belt. Climatic condition is ideal for bivoltine sericulture. The rearing seasons of this region are Spring, Summer and Autumn. The station is maintaining bivoltine mulberry silkworm germplasm, as well as, fixation of better breeds developed by the Japanese to the users throughout India (KPG-A, KPG-B).

On-going Research Project

MTL 02017 CN: Study on sericulture based IFS in hilly region of West Bengal

[March, 2022 to February, 2024]

Objectives:

- To study the present status of IFS in hilly region of West Bengal.
- To estimate the returns and costs of various farm enterprises individually as well as on aggregate level.
- To popularize the suitable IFS models through CBT programmes.

Progress:

- Data collection from the sericulture and non-sericulture, 60 numbers of farmers (30 experimental farmers+30 Benchmark) has been completed.
- Data analysis and identification of seri based Integrated farming system completed.
- The comparative economic of sericulture based IFS model and non - sericulture based IFS model is under progress.
- Secondary data collection from the BAES is completed.

Other R&D Programmes:

Maintenance and evaluation of Bivoltine/Multivoltine germplasm breeds: Bivoltine germplasm breeds collected from various sources maintained at RSRS, Kalimpong were reared during Spring 22 (April-May) crop. The cellular rearings were conducted. Rearing performance and cocoon characteristics were documented and verified against the passport data. The selected cocoons were utilized for seed production and all dfls acid treated and utilized during Summer. During Spring season, 53 germplasm breeds, 14 hybrids were reared. During summer 35 Germplasm and 14 breeds received from BHP were reared. During Autumn crop 11 Germplasm and 2 Hybrid and 1 (12Y) Multivoltine reared. 234 dfls produced during Spring crop 22 were acid treated for Summer crop. During Summer crop 332 dfls produced, 178 dfls kept in cold storage, 14 dfls utilized during Autumn 22 and 140 dfls sent to Berhampore. During Autumn crop 248 dfls produced, 135 dfls Germplasm (Cold storage) and 113 dfls Multivoltine sent to BHP and 612 gms loose eggs produced and sent to BHP for experimental purpose.

Performance of Bivoltine Silkworm Genetic Resources
Spring 2022 @ RSRS Kalimpong

Sl. No.	Race	Fecundity	Yield/10000 (ERR)		SCW	SSW	Shell %
			No	Wt (Kg)	(gm)	(gm)	
Pure Line							
1.	BBHR(W)	451	5000	6.520	1.521	0.213	14.00
2.	B.Con-1	518	6400	8.690	1.607	0.251	15.62
3.	B.con-4	519	6000	8.620	1.521	0.245	16.11
4.	BHP-1	509	7455	11.482	1.997	0.377	18.88
5.	BHP-2	546	5425	8.695	1.731	0.294	16.95
6.	BHP-3	487	6200	8.240	1.529	0.254	16.61
7.	BHP-9	473	3875	5.313	1.410	0.256	18.16
8.	BHR-1	540	5167	7.550	1.424	0.241	16.92
9.	BHR-3	361	5900	7.560	1.508	0.232	15.38
10.	BHR-13	426	6867	10.367	1.837	0.259	14.10
11.	BJ	462	4294	6.288	1.665	0.282	16.94
12.	BJ (W)	530	4739	6.165	1.355	0.233	17.20
13.	Changnang	488	2950	4.220	1.613	0.266	16.49
14.	CHSHSF	512	4167	6.525	1.673	0.269	16.04
15.	CSR-6	538	2273	2.741	1.255	0.213	16.97
16.	D-4	545	2600	3.292	1.498	0.207	13.82
17.	D6(M)	437	5083	6.675	1.270	0.182	14.33
18.	D6(P)	392	2750	3.325	1.504	0.207	13.76
19.	J122	408	6375	10.990	1.958	0.403	20.59
20.	JD6	569	3917	6.025	1.708	0.258	15.11
21.	KA-19	543	3675	5.410	1.564	0.278	17.79
22.	KA-19 (W)	518	3375	4.840	1.666	0.288	17.29
23.	KDH-1	522	7975	14.185	2.105	0.389	18.49
24.	KDH-2	446	5833	8.646	1.614	0.243	15.03
25.	KPG- 3	458	3500	4.903	1.760	0.269	15.30
26.	KPG- 4	509	3087	3.470	1.340	0.224	16.72
27.	KPG-5	535	3737	6.042	1.736	0.239	13.77
28.	KPG- 7	473	4250	6.225	1.372	0.223	16.25
29.	KPG -A	552	3357	5.493	1.946	0.330	16.96
30.	KPG -B	534	4400	6.300	1.379	0.247	17.91

31.	MC - 1	505	4667	5.547	1.731	0.291	16.81
32.	MC - 2	458	5400	8.060	1.658	0.267	16.07
33.	NB - 18	520	6533	8.973	1.380	0.224	16.23
34.	NB 4D2	457	5000	6.580	1.479	0.211	14.27
35.	P- 5	481	3700	6.380	1.284	0.227	17.68
36.	Pam- 105	566	4667	7.560	1.680	0.257	15.30
37.	SBK - 5	200	2633	3.840	1.685	0.263	15.63
38.	SF-19	468	2158	3.058	1.678	0.312	18.60
39.	SK 4 (II)	502	600	0.870	1.375	0.328	23.85
40.	SK 67	502	4400	6.220	1.579	0.232	14.69
41.	SK 67 (J)	494	5714	10.157	1.943	0.353	18.17
42.	SK67J(W)	565	4500	7.473	1.946	0.355	18.24
43.	SK - 7	510	3625	4.025	1.581	0.237	14.99
44.	WB-1	461	6867	10.380	1.471	0.247	16.79
45.	WB - 5	**507**	3200	4.603	1.683	0.267	15.85
46.	WB - 6	529	1556	2.100	1.698	0.283	16.67
47.	WB-7	534	6769	12.115	1.986	0.355	17.86
48.	WB - 8	549	4400	5.600	1.316	0.205	15.58
49.	WB - 9	396	4444	6.022	1.626	0.303	18.63
50.	WB – 9 (W)	507	3300	4.350	1.772	0.295	16.65
Hybrid							
51.	BHP 2 x 3	518	4739	7.591	1.780	0.287	16.13
52.	BHP 8 x 9	591	3756	5.519	1.661	0.279	16.78
53.	BHP 9 x 8	680	3333	5.067	1.347	0.211	15.66
54.	B.Con 1 x 4	561	7148	10.889	1.671	0.256	15.29
55.	B.Con 4 x 1	576	7708	12.771	1.716	0.231	13.47
56.	WB 1 x 3	463	6423	9.647	1.541	0.228	14.81
57.	WB 3 x 1	478	7950	12.968	1.666	0.273	16.36
58.	WB 7 x 9	519	7292	11.092	1.611	0.260	16.06
59.	WB 9 x 7	529	6771	10.389	1.476	0.256	17.18
60.	WB (3 X 1) x(9 x7)	593	6466	11.123	1.685	0.292	17.26
61.	WB (9 X 7) x(3x1)	606	5925	9.920	1.681	0.281	16.71
62.	SBK 5X 7	521	3683	5.230	1.254	0.178	14.17
63.	SK 6 X 7	541	4000	6.100	1.414	0.256	18.10
64.	SK 7 X 6	526	6300	8.690	1.356	0.211	15.65
Berhampore lot							
65.	NFC-19(W)	614	2750	3.794	1.267	0.187	14.76
66.	NFC-19(Dull)	528	1933	9.253	1.541	0.270	17.52
67.	NFCR(Dull)	483	5350	9.028	1.806	0.337	18.72

Performance of Bivoltine Breeds/Hybrids Autumn Crop 2022 @ RSRS Kalimpong

Sl. No.	Race	Fecundity	Yield/10000 (ERR)		SCW	SSW	Shell %
			No	Wt (g)	(g)	(g)	
1.	BHP-1	491	6100	9.330	1.567	0.260	16.59
2.	Changnang	531	7800	14.567	1.889	0.334	17.68
3.	KA-19(W)	387	6148	11.293	1.787	0.320	17.91
4.	KPG-B	405	5167	8.843	1.918	0.314	16.37
5.	KPG-7	544	4400	9.127	2.037	0.347	17.03
6	MC-1	378	8767	15.680	1.725	0.301	17.45
7	MC-2	384	9133	15.980	1.747	0.317	18.15
8	NB-18	451	4333	6.559	1.531	0.259	16.92
9	P5	554	7733	15.133	1.575	0.325	20.63
Berhampore Lot							
1	GB(E)	444	6600	11.378	1.711	0.280	16.36
2	GB(R)	435	8380	14.668	1.798	0.301	16.74
3	WB(1 x 3) Mass	522	6914	12.573	1.794	0.339	18.90
4	WB(5 x7) Mass	477	6675	13.224	1.888	0.356	18.86
5	12 Y (Labex	360	7556	11.794	1.721	0.262	15.22
6	12 Y (Seriwin)	360	7806	12.053	1.698	0.269	15.84

❖ **Survey and surveillance of mulberry pests in the Eastern and North Eastern regions of India**

The station is endorsed to record periodical incidence of mulberry root mealy bug in Kalimpong hills along with meteorological data. Incidence of mulberry root mealy was recorded at fortnightly intervals in the field of RSRS Kalimpong along with one DoT (Seri) farms, Govt. of WB, namely, SDF Pedong and from Dolopchand village and Echhay village.

Periodical incidence of mulberry root mealy bug in Kalimpong hills

Incidence	Apr	May	Jun	Jul	Aug	Sep
Average	1.22	1.12	1.61	1.38	2.28	2.46
Range	0.6-1.98	0.4-1.76	0.70-2.45	0.45-1.2	1.4-2.8	1.8-2.9
Incidence	Oct	Nov	Dec	Jan	Feb	Mar
Average	2.66	1.88	1.35	1.15	1.25	0.97
Range	2.1-2.8	1.4-2.4	1-1.8	1-1.3	1.1-1.4	0.76-1.2

Transfer of Technologies:

❖ **Validation of Eco-Friendly bed Disinfectant SERIWIN**

During Summer crop 2022, performance of SERIWIN an eco-friendly bed disinfectant developed by CSR&TI Berhampore was validated.

❖ **Low Cost Drip Fertigation for Mulberry:** Fertigation as per schedule was completed. Owing to three crop schedule in the region leaf moisture/leaf yield data collected from Spring Crop '23 and sent to concerned section.

❖ **Forewarning of mulberry diseases of Eastern & North Eastern India:** Data on disease incidence of mulberry were recorded at fortnightly interval from the RSRS Farm and the farmers'field. Average monthly data on disease incidence is given below:

Diseases	(PI/ PDI)	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan'23 – Mar'23
Brown Leaf Rust	PI	No -Incidence	2.68	4.36	5.82	4.27	3.65	3.18	2.05	-	No data recorded as plants were pruned
	PDI		1.22	2.32	2.67	2.06	1.86	1.14	1.22	-	
Yellow Leaf Rust	PI		-	-	4.75	3.17	4.23	4.76	3.16	-	
	PDI		-	-	1.6	1.87	1.95	2.08	1.42	-	
Powdery Mildew	PI		-	-	-	-	2.87	3.24	2.32	-	
	PDI		-	-	-	-	1.24	1.84	1.88	-	

Resham Krishi Mela

RSRS- Kalimpong organized a Resham Krishi Mela on 07.02.2023 at Officers Club, Namchi, Sikkim. It was inaugurated by the Chief Guest Dr. I.P. Shivkoti, Sr. Scientist & Head, KVK, Namthang by lighting the lamp. Welcome speech given by Dr. Harish Babu, S., Sc-C (I/C), RSRS Kalimpong. A pamphlet entitled, "Late age Silkworm Rearing"in Nepali Vernacular language was released by Director CSRTI, Berhampore. The Guest of Honour, Mrs. Srijana Chettri, DFO (Sericulture) Dept. of Forest and Envi. Govt. of Sikkim, delivered a lecture explaining the role of women farmers in strengthening the sericulture in hilly region of Sikkim, followed by the Chief Guest I.P. Shivkoti, Sr. Scientist & Head, KVK, Namthang, briefed about role of KVK for expanding the Sericulture in South Sikkim, final speech was given by the president of the programme, Dr. Kishor Kumar, Director, CSR&TI, Berhampore and explained importance of new mulberry Variety TR-23 for production of bivoltine silk which is especially suitable for hilly region. A Technical interaction among the farmers and scientists was organized, many doubts of farmers regarding soil to silk were addressed in the event. Dr. K. Suresh, Sc-C and Dr. Mihir Rabha, Sc-C, CSR&TI, Berhampore made power point presentation for updating the knowledge to mulberry sericulture farmers of Sikkim hills.

Photographs of RKM conducted at Namchi, Sikkim

Other Activities:

- Expansion of area under sericulture in the adjoining state of Sikkim; $BC_2$59 cuttings supplied to the farmers through KVK Namthang, Sikkim.
- One radio programme in the local vernacular Nepali was recorded at All India Radio, Kurseong radio station, Darjeeling and aired on 30.03.2023.
- Conducted Swachhata Pakwada programme from 01.03.2023 to 15.03.2023 at this station.
- Conducted 10 days training cum exposure visit prog. on Mulberry Sericulture for Dhoon valley Agriculture College, Students, held at RSRS, Kalimpong from 20.06.2022 to 24.06.2022 & 04.07.2022 to 08.07.2022.
- Collected 25 Soil samples of Kalimpong Farmers & sent to CSR&TI Berhampore for analyses.

PHOTOGRAPHS OF OTHER ACTIVITIES

FFD at Gitabling village, Kalimpong.

Awareness Prog. at Lingsay village, Kalimpong

Aw. Prog. at Pemling, Kalimpong on 13.03.23

FFD at Dolopchand village, Kalimpong.

Farmers field day at Tashiding Sikkim on 10.03.23

TD at Echhey village, Kalimpong.

RSRS KORAPUT ODISHA

RSRS, Koraput (Odisha) was established to provide R & D support to the mulberry sericulture in Odisha. It caters technical services to the mulberry Seri-farmers in coordination with the DoT & handlooms, Government of Odisha.

Research Project implemented

PIE02003SI: Evaluation of the performance of mulberry Genotype C-9 under red and laterite soils.

Plots maintained with 100% survivality, routine cultural practice. Collected data for three crops, i.e.: Aug.-Sept., 2022, Oct.-Nov., 2022 and Feb.-Mar.,2023 and submitted to PI of the project (CSR&TI, Berhampore) for overall compilation & analysis.

PIC13001MI (AICEM-IV): All India co-ordinated experimental trial for mulberry varieties.

Maintained 100% survivability of the experimental mulberry varities through routine intercultural operations, application of fertilizers and other plant protection measures. Data for three crops (Aug.-Sept.,2022, Oct.-Nov., 2022 and Feb.-Mar., 2023) has been recorded and submitted for overall compilation.

PIB02010SI: Final yield trial of promising high yielding mulberry genotypes for Eastern and North-eastern India.

Plantations were maintained with 90% survivavility along with weeding, watering & light hoeing. FYM and NPK dose has been applied as per recommendation. Data for three crops (Aug. - Sept., 2022, Oct.-Nov., 2022 and Feb.-Mar., 2023) were recorded and submitted to CSRTI-Berhampore for overall compilation.

#	Variety	Saplings/Cuttings	Survivality (%)
01	PPY-08	Sapling	98 %
02	PYD-07	Sapling	92 %
03	C-2038	Sapling	96 %
04	PYD-08	Sapling + Cutting	84 %
05	PPY-10	Sapling	94 %
06	PYD-27	Sapling + Cutting	88 %
07	PPY-24	Sapling + Cutting	90 %
08	PYD-01	Sapling	97 %
09	C-1730	Sapling	97 %

MOE02014SI and MOE02015MI: Popularization of Improved Technologies Developed in the Field of Mulberry Sector for Eastern and North-Eastern India.

Extension Communication Programme (ECP): Famers Field Day, Technology Awareness Meet and Technology Demonstration etc.

Capacity Building Training Programme: Farmers Skill Training programme (5 days) in two batches with 25 farmers / batch on "Chawki & Late Age Rearing Technology" was conducted.

Exposure visit of 25 farmers to Bastar, Lohundiguda areas of Chhattisgarh was organized by the Centre for the period w.e.f. 20.02.2023 to 23.02.2023.

Maintenance of Bi and Multivoltine silkworm races: Bi and Multivoltine races collected from various sources are being maintained at RSRS-Eri BSF, Koraput. Maintenance has been carried out through cellular rearing and by adopting the existing standard procedure. Rearing performance data were recorded in five different crop seasons of the year (2022-23) and selected cocoons were utilized for seed production.

Rearing performance of Bi and Multivoltine silkworm breeds and races during 2022-23.

(Mean values: Season: 5 Nos. May-June' 22/ July-Aug' 22/ Sept-Oct'22/ Nov-Dec'22/ Feb-Mar' 23)

#	Breed/ Race	Crop	Fecund-ity	Hatching %	Yield /10000 larvae brushed		Single		SR %
					Nos.	Wt. (kg)	Cocoon wt. (g)	Shell wt. (g)	
A	**Bivoltine**								
01	SK-06	Mean of 5 season of 1 year	480	94.16	9146	11.12	1.372	0.2718	19.33
02	SK-07		478	94.27	9066	12.186	1.334	0.260	19.52
03	Bcon 1		487	93.42	9029	11.426	1.397	0.271	19.40
04	Bcon 4		522	95.40	8971	12.077	1.449	0.276	19.36
05	FC1	Feb-March 23	491	92.66	9633	13.611	1.422	0.233	16.40
06	FC2	Feb-March 23	500	94.40	9600	14.389	1.822	0.285	15.65
B	**Multivoltine**								
01	M6DPC	**MEAN**	464	93.55	8428	8.596	1.174	0.180	15.29
02	M6M81	**MEAN**	460	94.34	9437	9.851	1.147	0.170	14.84
03	M12W	**MEAN**	457	95.24	8626	9.281	1.220	0.192	15.71
04	MCon4	**MEAN**	464	94.50	8697	8.681	1.069	0.160	14.96
05	Nistari	**MEAN**	453	94.94	8517	9.589	1.072	0.167	15.15

Maintenance of Eri silkworm races/breeds

The Eri silkworm breed C-02 has been maintained at RSRS-Eri BSF during 2022-23. Maintenance has been carried out through cellular rearing and by adopting the existing standard procedure. Rearing performance data conducted during 2022-23 were recorded in different crop seasons are as follows:

Rearing performance C-02 Eri silkworm breed in different crops during 2022-23

#	Breed/ Race	Crop	Nos of dfls	Hatching %	Cocoon yield		Yield (no)/kg	Cocoon wt. (g)	Shell wt. (g)	SR (%)
					Wt (Kg)	Nos.				
1	C-02	April-May	35	80	5.783	2255	390	2.66	0.42	15.66
2	C-02	Sep-Oct;22	50	80	34.80	13780	396	2.53	0.31	12.25
3	C-02	Nov-Dec' 22	05	75	4.30	1290	300	2.30	0.27	11.74
4	C-02	Jan-Feb'23	50	80	10.025	4411	440	2.25	0.30	13.33
5	C-02	Feb-March' 23	10	90	6.300	2709	430	2.37	0.33	13.92

OTHER MAJOR ACTIVITIES:

- Conducted various activities under Swachhata Mission in office premises and neighbouring villages, Schools, Community centres etc.
- Vigilance awareness programme. Vigilance pledge has been taken by all the employees and a senior advocate Mr. C. Sathpatty who was invited to deliver a talk on Vigilance related issues. A Vigilance awareness programme was organized at the village Badliguda, a rally with Vigilance Slogans was also conducted.

PHOTOGRAPHS OF DIFFERENT ACTIVITIES

Evaluation of C-09 in red laterite soil

BLS resistance C7 Mulberry variety

AICEM (Phase-IV) trial for mulberry

Evaluation of Seri-win bed disinfectant

Popularization of Shoot feeding

Demonstration of technology

Chrysoperla zatrowi sillemi for pest control

Eri Silkworm race maintenance

Farmers' Field Day Programme

Tech. Aw. Meet organized by RSRS, Koraput at Borigumma, Odisha

FSD programme

RSRS JORHAT, ASSAM

Regional Sericultural Research Station, Jorhat is engaged in R&D activities in mulberry sericulture under the technical and administrative control of CSRTI-Berhampore. To improve production and productivity in mulberry sericulture in N.E. States, six RECs namely, Shillong (Meghalaya), Aizwal (Mizoram), Dimapur (Nagaland), Agartala (Tripura), Mangaldoi (Assam) and REC Sille, Arunachal Pradesh were established by Central Silk Board under the control of Regional Sericultural Research Station, Jorhat. These extension centers are constantly working towards the extension & development activities in mulberry sericulture in particular.

Research Project implemented

MOE02014SI and MOE02015MI: Popularization of Improved Technologies Developed in the Field of Mulberry Sector for Eastern and North-Eastern India.

PIC13001MI (AICEM-IV): All India co-ordinated experimental trial for mulberry varieties.

BV-CPP Programme: As a follow-up of the BV-CPP programme for Jorhat Cluster, rearing of bi-voltine crops was continued and during Spring, 2022, 9000 dfls were brushed, 1424.35 kilograms of green cocoons were harvested and 158 kilograms of raw silk was produced. During late spring crop, 2022, 10000 dfls were brushed, 2970 kilograms of green cocoons were harvested and 293 kilograms of raw silk was produced.

Routine Programmes: Data recording on survey and surveillance for mulberry and silkworm is recorded regularly as a continuous activity.

Extension Communication Programmes (ECPS)

Capacity Building and training: CBT programme were fully conducted by the station as per schedule. Details of the CBT programmes is presented below.

Sl. No.	Name of the Unit	Annual Target (2022-23)	Total stakeholders trained	Achivement (%)
1)	Farmers Skill Training Programmes	10 days / 50 farmers; 25 farmers in 2 batches	50	100
2)	Exposure visit	25 farmers	25	100
3)	ToT training programme for KVK Scientists	24 scientists	10	41.66

PHOTOGRAPHS OF THE ACTIVITIES

FST Traning prog.

Awarness proramme

Hands on Training

राजभाषा अनुभाग की उपलब्धियाँ (वर्ष 2022- 2023)

केन्द्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान,बहरमपुर (प.बं.) में वर्ष 2022-23 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।

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

1. **धारा-3(3) का अनुपालन**: राजभाषा अधिनियम की धारा-3(3) के 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: 85.65%,तथा 'ग' क्षेत्र में स्थित केन्द्रीय सरकार के कार्यालयों को 76.49% पत्र हिन्दी में भेजें गए। इस प्रकार पत्राचार के मद में निर्धारित लक्ष्य से अधिक पत्राचार किया गया।
3. **हिन्दी प्रशिक्षण:** आलोच्य अवधि के दौरान अधिकारियों/कर्मचारियों को हिन्दी शिक्षण के योजना के अधीन प्रशिक्षण कार्य जारी है। अब तक संस्थान के कुल 98.95% 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 2022-23 के अंतर्गत राजभाषा कार्यान्वयन समिति की चार बैठकों का नियमित आयोजन क्रमश: दिनांक 09.06.2022, 30.07.2022, 17.11.2022 एवं 13.02.2023 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 13.06.2022,08.09.2022, 15.11.2022 एवं 23.01.2023 को हिंदी कार्यशाला आयोजित कर संस्थान के कुल 104 पदधारीगण राजभाषा हिन्दी में प्रशिक्षित किए गए तथा आगे भी यह क्रम जारी है।
6. **अधीनस्थ कार्यालयों/केन्द्रीय रेशम बोर्ड के अन्य कार्यालयों आंबटित कार्यालयों में हिन्दी कार्यशाला**: संस्थान की संबद्ध इकाइयों में भी संघ की राजभाषा नीति के सफल कार्यान्वयन हेतु हिन्दी कार्यशालाओं का आयोजन किया जाता है। इस क्रम में संस्थान के कुल 05 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 अन्तर्गत निर्धारित शब्द संख्या हिन्दी में लिखने पर अनुपाततः नगद प्रोत्साहन राशि (महत्तम रू 5000.00) प्रदान की जाती है। हिन्दी दिवस/पखवाड़ा,2022 के अवसर पर वर्ष 2021-22 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 2021-22 का सारांश हिंदी में प्रकाशित करने के अतिरिक्त आलोच्य अवधि के दौरान गंगा, रत्ना [हिंदी, अंग्रेजी व बंगला] व चॉकी शहतूत बगीचा नामक पैम्फलेट [हिंदी, अंग्रेजी व बंगला] 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। समिति के प्रयास से नगर स्थित केन्द्रीय सरकार के कार्यालयों/बैंकों/निगमों/उपक्रमों/संगठनोंआदि में भी राजभाषा गतिविधियां बढ़ी है। इसके अतिरिक्त,नगर के सदस्य कार्यालय अपने-अपने कार्यालयो 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 अन्तर्गत 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 05 संबद्ध कार्यालयों को अधिसूचित कराया जा चुका है।
11. **हिन्दी प्रतियोगिता का आयोजन**: वर्ष 2022-23 के दौरान दिनांक 01.09.22 से 30.09.22 तक आयोजित हिन्दी पखवाड़ा के अन्तर्गत विभिन्न हिन्दी प्रतियोगिता एवं मुख्य समारोह का आयोजन किया गया। इन प्रतियोगिता में संस्थान के अधिकारियों/ कर्मचारियों ने उत्साह से भाग लिया। इस दौरान कुल 04 हिन्दी प्रतियोगिताओं क्रमशः शब्दावली 01/09/2022, हिंदी टिप्पण व आलेखन प्रतियोगिता 02/09/2022, निबन्ध 03/09/2022 तथा सुलेख व श्रुतिलेख 05/09/22 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/ संपादनका कार्य तथा नगर राजभाषा कार्यान्वयन समिति की गतिविधियों संबंधी कार्य को कंप्यूटरपर 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 समिति की बैठको में हिन्दी प्रगति से संबंधित आकड़ों का प्रस्तुतीकरण पावर-प्वाइंट के जरिये किया जा रहा है। ज्ञातव्य 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।

AWARDS AND RECOGNITIONS

- **Eminent Scientist Award** (2022) to **Dr. Satadal chakrabarty** for his outstanding contribution in the field of Parasitology and Silkworm Pathology from Vigyan Varta, an International E-Magazine for Science Enthusiasts (E-ISSN: 2582-9467), Bhubaneswar, Odisha, India. *www.vigyanvarta.com.*
- **Certificate of Excellence in Peer** Reviewing to **Dr. Satadal Chakrabarty**, in recognition of an outstanding contribution to the quality of the journal *Uttar Pradesh journal of Zoology* issued by MB International Media and Publishing House. Certificate No. MBIMPH/PR/Cert/2192/DRS dated; 26-Nov-2022.

- National Seminar on Climate Smart Sericulture-2022 held on 5th to 6th Oct., 2022 organised by Central Silk Board, Bangalore :
  - ✓ Best poster presentation award to Dr. Pooja Makwana for the research work titled "**Identification of new *Serratia* sp. in mulberry silkworm *Bombyx mori***".
  - ✓ Best oral presentation award to Dr. Chandrakanth, N. for the research work titled "**A new thermotolerant bivoltine double hybrid WBDH1 for Eastern & North-Eastern India."**
  - ✓ 2nd best poster presentation award to Dr. Thongjam Ranjita Devi for the research work titled "***Cold reeling- An agent of selection in breeding programme of Nistari a multivoltine breed in sericulture***"

DISTINGUISHED VISITORS AT INSTITUTE/UNITS:

Dr.Katsuhiko Ito, Associate Professor, Department of Science of Biological Production, Graduate School of Agriculture, Tokyo University of Agriculture & Technology, Tokyo, Japan, International Collaborator in the DST-JSPS-CSB funded research project "AIT02012CI: Characterization of mulberry silkworm, *Bombyx mori* L. mutants for tolerance to flacherie syndrome through genome editing tools", visited CSR&TI, Berhampore from 10th October 2022 to 16th October 2022. During his visit, he attended the International Conference on Climate Resilient Sericulture organized by CSB, Bangalore. Dr. Ito delivered a talk on Genome editing and microinjection techniques in silkworms. The project activities including target *nsd* gene, expression analysis after pathogen infection, designing guide RNA, and preparation of construct are discussed at length.

STAFF PROFILE (2022-23) As on 31st March, 2023				
Designation	**MI**	**RSRSs**	**RECs**	**Total**
Director	1	-	-	**1**
Scientists				
Scientist-D	4	-	2	**6**
Scientist-C	12	1	-	**13**
Scientist-B	-	-	-	**-**
Technical				
Deputy Director (Comp)	1	-	-	**1**
Deputy Director (OL)	-	-	-	**-**
Sr. Technical Asst. (STA)	29	14	15	**58**
Junior Engineer	1	-	-	**1**
Sr. Field Asst.	-	-	1	**1**
Field Asst.	2	3	5	**10**
Technician	6	1	-	**7**
Asst. Technician	4	-	-	**4**
Multi Tasking Staff	7	9	7	**23**
Skilled Farm Worker	25	11	6	**42**
Skilled Farm Worker (TS)	16	37	20	**73**
Accounts & Administration				
Asst. Director	3	-	-	**3**
Superintendent	1	-	-	**1**
Asst. Supdt.	10	-	-	**10**
Stenographer -Grade-I	1	-	-	**1**
Sr. Translator (Hindi)	1	-	-	**1**
Staff Car Driver Grade-I	-	2	-	**2**
UDC	4	-	-	**4**
Stenographer-Grade-II	-	-	-	**-**
Cook	1	-	-	**1**
Total	**129**	**79**	**55**	**263**

बजट / Budget 2022-23	
शीर्ष /Head	**राशि/ Amount (रु. लाख़ में/ Rs. in lakh)**
प्लान-वेतन (पीएलएस)/ Plan-Salary (PLS)	2062.47
अनुसूचित जाति वेतन (एससिएस) **/Schedule Caste Salary (SCS)**	369.00
अनुसूचित जनजाति वेतन (एसटीएस) / **Schedule Tribe Salary (STS)**	299.58
उत्तर-पूर्वी-वेतन /NE-Salary (NE-S)	497.20
उत्तर-पूर्वी- जनजाति वेतन/ NE-ST-Salary (NE-TS)	236.82
प्लान-सामान्य **/ Plan-Gen (PLG)**	448.75
प्लान-कैपिटल (पीएलसि) **/ Plan-Cap (PLC)**	23.33
उत्तर-पूर्वी - कैपिटल (एनईसि) **/ NE-Cap (NEC)**	3.02
कुल **/Total**	**3940.17**

R & D PERSONNEL

CSRTI-BERHAMPORE

Director

Dr. Kishor Kumar C.M.

Scientist-D

Dr. Dipesh Pandit
Dr. Lakshmanan Velusamy (upto 10.06.2022)
Dr. Pradeep A.R.
Dr. Satadal Chakraborty
Dr. Srinivas G.

Scientist-C

Dr. Chandrakanth, N.
Dr. Pooja Makwana
Dr. Rahul K
Dr. Shafi Afroz
Dr. Suresh K
Dr. Deepika Kumar Umesh
Mr. Khasru Alam
Dr. Mihir Rabha
Dr. Parameshwaranaik, J
Dr. Raviraj, V.S
Dr. Thangjam Ranjita Devi
Dr. Yallappa Harijan

ADMINISTRATIVE PERSONNEL

Mr. Prasad P. K., DD (Comp.)
Mr. Abdul Latif Qureshi, AD(A&A) (upto 31.07.22)
Mr. Khemraj Nishad, AD (A&A)
Mr. Asim RoyChaudhury, AD (A&A) (fr. 13.01.23)
Mr. Sohan Lal Sahu, AD (A&A) (fr. 03.01.23)

RSRS-KALIMPONG

Mr Zakir Hossain, Scientist-D (upto 31.12.22)
Dr. S. Harish Babu, Scientist-B (fr. 01.01.23)

RSRS-KORAPUT

Dr. Dip Kumar Gogoi, Sci-D (upto 25.03.23)
Smt. Padmabati Raju, STA (fr. 26.03.2023)

RSRS-JORHAT

Dr. P. Kumaresan, Sci-D (upto 04.06.22)
Dr. Karthik Neog, Sci-D (fr. 05.06.22 to 16.03.23)
Smt. Junumoni Das, STA (fr. 17.03.23)

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Mr. Boya Vijoy Naidu, Sci-D

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Mr. Imtinokchung, STA (fr. 01.06.22)

REC-MONGALDAI

Mr. B. K. Basumatary, Sci-D (upto 30.11.22)
Mr. Ujjwal Kanti Paul, STA (fr. 01.12.22)

REC-SHILLONG

Dr. N. Balchandran, Sci-D (upto 18.03.23)
Mr. Dwijan Chandra Das, STA (fr. 19.03.23)

REC-AIZWAL

Dr. N. Shaktivel, Scientist-D (upto 18.03.23)
Mr. Utpal Bora, F.A. (fr. 19.03.23)

REC, SILLE

Mr. Lohit Sonowal, Sci- C
(Shifted under CMERT, Ladoigarh frfrom 1.2.23)

REC-AGARTALA

Dr. Narayan Biswas, Scit-D (upto 31.01.23)
Mr. Salam Bijoy Meitei, STA (fr. 01.02.23)

RESEARCH ADVISORY COMMITTEE (RAC)

RAC is a body for evaluation of research projects at Institute level consisting of specialists in different subject matter from reputed institute/universities. The tenure of the committee shall be for 3 years (6 meetings), the committee will meet once in six months for review of R&D activities of the institute.

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Dr. Chirantan Chattopadhyay,
(Ex-Vice Chancellor, UBKV)
Principal Scientist (Plant Pathology)
Central Seed Research Station for Jute & Allied Fibres
ICAR: Central Research Institute for Jute & Allied Fibres
Bud Bud – 713 403, Purba Bardhaman (WB), INDIA

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Dr. Debabrata Basu, Professor & Head, Department of Agricultural Extension, Bidhan Chanadnra Krishi Viswavidyalaya (BCKV), **Mohanpur -741 252**, Nadia, West Bengal	Dr. S. Nirmal Kumar, Director (Retired)-CSB, #1169, II Main, II Cross, SRIRAMPURA, IIStage, **Mysore -570 023,** Karnataka
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Joint Secretary & Director, Deptt. of Handlooms Handicrafts & Sericulture, Govt. of Tripura, lndra Nagar, PO-Kunjaban, **Agartala - 799 006,** Tripura	Commissioner, Textiles & Sericulture, Govt. of West Bengal, New Secretariat Building, 6th Floor, Block-A, 1 Kiran Sharkar Ray Road, **Kolkata - 700 001,** West Bengal
Director of Sericulture, Govt. of Manipur, Project Management Complex, Sangaipat, lmphal East, **Imphal - 795 004,** Manipur	Director, National Silkworm Seed Organization(NSSO), Central Silk Board, CSB Complex, BTM Layout, Madiwala, **Bengaluru - 560 068,** Karnataka
Director (Technical), Central Silk Board, CSB Complex, BTM Layout, Madiwala, **Bengaluru - 560 068,** Karnataka	Scientist-D & Head,Research Coordination Section, Central Silk Board, CSB Complex, BTM Layout, Madiwala, **Bengaluru - 560 068,** Karnataka

MEMBER CONVENOR
Dr. Kishor Kumar C.M., Director, CSRTI-Berhampore (WB)

केरेउअवप्रसं-बहरमपुर की/ CSRTI-Berhampore's
आभार-विदाई / Grateful Farewell

#	पदधारी /Employee	पदनाम /Designation	सेवानिवृत/ Retirement
1.	श्री किशलय भादुरी/ Shri Kishalay Bhadury	सहायक अधीक्षक (प्रशा.), केरेउअवप्रसं-बहरमपुर/ Asst. Supdt. (Admn.), CSR&TI, Berhampore	12.04.2022 (VR)
2.	श्री सुरेश मोहापात्र /Shri Suresh Mohapatra	एमटीएस, आरएसआरएस, कोरापुट,ओडिशा/ MTS, RSRS, Koraput, Odisha	30-04.2022
3.	श्रीमति निता मुखर्जी/Smt. Nita Mukharjee	वरिस्ठ तक. सहा., केरेउअवप्रसं-बहरमपुर /Sr. Tech. Asst., CSR&TI, Berhampore	30.04.2022
4.	श्री निखिल रंजन साहा/Shri Nikhil Ranjan Saha	वरिस्ठ तक. सहा., केरेउअवप्रसं-बहरमपुर / Sr. Tech. Asst., CSR&TI, Berhampore	30.06.2022
5.	मो. साईयद्द भद्रुजा/Md. Sayed Badrudduza	वरिस्ठ तक. सहा., केरेउअवप्रसं-बहरमपुर /Sr. Tech. Asst., CSR&TI, Berhampore	30.06.2022
6.	मो. अब्दुल लतीफ कुरेशी/Md. Abdul Latif Qureshi	सहायक निदेशक(प्र.व ले.),केरेउअवप्रसं-बहरमपुर/ Asst. Dir. (A&A), CSR&TI, Berhampore	31.07.2022
7.	श्री दिव्येंदु सरकार/Shri Dibyendu Sarkar	वरिस्ठ तक. सहा., केरेउअवप्रसं-बहरमपुर /Sr. Tech. Asst., CSR&TI, Berhampore	31.08.2022
8.	श्री कोरा बरामुंडी/ Shri Kora Baramundi	एमटीएस, आरएसआरएस, कोरापुट, ओडिशा/ MTS, RSRS, Koraput, Odisha	31-08.2022
9.	श्रीमति पम्पा घोष/Smt. Pampa Ghosh	वरिस्ठ तक. सहा., केरेउअवप्रसं-बहरमपुर /Sr. Tech. Asst., CSR&TI, Berhampore	29.09.2022 (Expired)
10.	श्री माखन चंद्र शर्मा / Shri Makhan Chandra Sarma	एमटीएस, आरएसआरएस, जोरहाट /MTS, RSRS, Jorhat)	30-09.2022
11.	श्री निर्दोश शेरिंग लेप्चा/Shri Nirdosh Tshering Lepcha	स्टाफ कार चालक, आरएसआरएस,कालिम्पोंग/ Staff Car Driver, RSRS, Kalimpong	08.07.2022 (Expired)
12.	श्री त्रिलोचन मांझी/ Shri Trilochan Majhi	एमटीएस, आरएसआरएस, कोरापुट, ओडिशा/ MTS, RSRS, Koraput, Odisha	30-09.2022
13.	श्री चन्दन कुमार भारती/ Shri Chandan Kumar Bharti	वरिस्ठ तक. सहा., आरईसी,भडरा /Sr. Tech. Asst., REC, Bhandra	31.10.2022
14.	श्री बेनेडिक्ट कुमार बासुमातारी/Shri Benedict Kumar Basumatary	वैज्ञानिक-डी, आरईसी, मनगल्दोई, आसाम/ Scientist-D, REC, Mangaldoi, Assam	30.11.2022
15.	मो. जाकिर होसेन/Md. Zakir Hossain	वैज्ञानिक-डी, आरएसआरएस, कालिम्पोंग/ Scientist-D, RSRS, Kalimpong, WB	31.12.2022
16.	श्री पुर्बा वागांडि शेर्पा/Shri Purba Wangdi Sherpa	वरिस्ठ तक. सहा., आरएसआरएस,कालिम्पोंग/ /Sr. Tech. Asst. RSRS, Kalimpong	31.12.2022
17.	श्री बिश्वजित बिस्वास/Shri Biswajit Biswas	वरिस्ठ तक. सहा., केरेउअवप्रसं-बहरमपुर /Sr. Tech. Asst., CSR&TI, Berhampore	31.12.2022
18.	श्रीमति मंजु मोनि माहांत /Mrs. Manju Moni Mahanta	सहायक अधीक्षक (प्रशा.), आरएसआरएस, जोरहाट /Asstt. Supdt.(Admn.), RSRS, Jorhat)	31-01-2023
19.	श्री नरेन लोहार / Shri Noren Lohar	उच्च श्रेणी लिपिक, आरएसआरएस, जोरहाट, आसाम/ UDC, RSRS, Jorhat, Assam	31-01-2023
20.	श्री तुषार रंजन मूखार्जी / Shri Tushar Ranjan Mukherjee	वरिस्ठ तक. सहा., केरेउअवप्रसं-बहरमपुर /Sr. Tech. Asst., CSR&TI, Berhampore	31-01-2023
21.	डॉ. नारायण विश्वास /Dr. Narayan Biswas	वैज्ञानिक-डी, आरईसी, अगरतला, त्रिपुरा/ Scientist-D, REC, Agartala, Tripura	31-01-2023
22.	श्री कंगालु मुंडा/ Shri Kangalu Munda	खेत्र सहायक, आरएसआरएस, कोरापुट, ओडिशा/ FA, RSRS, Koraput, Odisha	31.01.2023

23.	श्री आशिश घट्क/Shri Asis Ghatak	सहायक अधीक्षक (प्रशा.), केरेउअवप्रसं-बहरमपुर/ Asst. Supdt. (Admn.), CSR&TI,Berhampore	31.01.2023
24.	श्री विश्वरंजन सरकार/Shri Biswaranjan Sarkar	वरिस्ठ तक. सहा., केरेउअवप्रसं-बहरमपुर /Sr. Tech. Asst., CSR&TI, Berhampore	31.01.2023
25.	श्री प्रदीप कुमार चौधुरी/Shri Pradip Kumar Choudhury	वरिस्ठ तक. सहा., केरेउअवप्रसं-बहरमपुर /Sr. Tech. Asst., CSR&TI, Berhampore	08.03.2023 (VR)
26.	काजी मो. फरहात होसेन/ Kazi Md. Farhat Hossain	सहायक अधीक्षक (प्रशा.), केरेउअवप्रसं-बहरमपुर/ Asst. Supdt. (Admn.), CSR&TI,Berhampore	31.03.2023

PUBLICATIONS

Research Papers (International):

1. Alam, K., Raviraj, V.S., Kar, P.K. and Chakrabarty, S. (2022). Diversity in wild tasar (*Antheraea mylita* D.) ecoraces of Simlipal biosphere reserve with respect to cocoon and associated parameters, *Plant Archives;* Volume- 22 : Special Issue. pp.36-39. (NASS: 4.73)
2. Alam, K., Harjan, Y., Kire, Z., Harish Babu, S., Kishor Kumar, C.M. and Singh, A. (2023). Field efficacy of *Chrysoperla zastrowi sillemi* (Esben-Petersen) against mulberry whitefly *Dialeuropora decempuncta* (Homoptera: Aleyrodidae). *Pharma Innovation*, 12(3):3780-3783. (NAAS:5.23)
3. Chakrabarty, S., Ranjita Devi, T., Dutta Biswas, T., Saha, A.K. and Bindroo, B.B. (2023). Problems and Prospects of Seed Cocoon Generation (Nistari & SK6 x SK7) in Murshidabad District of West Bengal, India. *Int. Journal of All Education Research and Scientific Methods* (IJARESM); ISSN2455-6211. 11(1): 536-549 (Impact factor: 7.429): www.ijaresm.com.
4. Chakrabarty, S., Paul, S. K., Saha, A.K. and Bindroo, B.B. (2022). Studies on efficacy of Ghar Sodhon – a fumigant room disinfectant used in sericulture in comparison with Sanitech Super- a chlorine dioxide-based room disinfectant and 5% Bleaching Powder solution as control. *Int. Journal of All Education Research and Scientific Methods* (IJARESM), ISSN2455-6211. 10(4): 217- 230 (Impact factor: 7.429): www.ijaresm.com.
5. Hossain, Z. and Rahul, K. (2022). Morphological and molecular identification of fungi isolated from insect pests of mulberry pathogenic to silkworm *Bombyx mori* L. *Science, Technology and Development,* 11(5): 10–18.
6. Kurmi, D., Rabha, M. and Rahul, K. (2023). Extraction of sericin protein from *Bombyx mori* L. cocoon (Race Nistari). *Pharma Innovation*, 12(2): 270–274.
7. Rahul, K., Anil, P., Pooja, M., Mihir, R. and Sivaprasad, V. (2022). Efficacy of phototrophic bacterial feed supplementation on economic traits and disease resistance in mulberry silkworm, *Bombyx mori* (Lepidoptera: Bombycidae). *Revista de la Sociedad Entomológica Argentina*, 81(3):28–40.
8. Rahul, K., Kweon, H.Y., Kim, H.B. and Lee, J.H. (2022). *In vitro* screening of anti-skin aging and antioxidant properties of aqueous/ solvent extracts from distinctive stages of silkworm (*Bombyx mori* L.) pupae. *Int. Journal of Industrial Entomology*, 45(1): 1–11.

9. Rahul, K., Kweon, H.Y., Kim, H.B. and Lee, J.H. (2022). Evaluation of the anti-inflammatory effects of silkworm (*Bombyx mori* L.) pupal extracts against lipopolysaccharide-induced inflammation in the murine macrophage cell line (RAW264.7). *Int. Journal of Industrial Entomology*, 45(2): 99–107.
10. Rabha, M., Das, D. and Konwar T. (2023). Whole genome sequencing of a novel *Bacillus thuringiensis* isolated from Assam soil. *BMC Microbiology*, 23(91): 1–14.
11. Goswami, J., Gogoi, D. K., Rasid, N., Handique, B. K., Subrahmanyam, G., Bora, P. P., Das, R. and Raju. P. L. N. (2023). Development of a Muga disease early warning system - a mobile-based service for seri farmers. *Current Science*, 121 (10): 1328-1334. [Impact Factor: 2.492]

Abstract :In Korean

1. 김현복, 차익섭, 이지혜, 권해용, Kamidi Rahul, 최정숙 (2022) 기능성 증진 처리 뽕 산물을 이용한 가공제품 제조방법 개발 및 기능 성분 함량 비교. The 65th (1) Conference of the Korean Society of Sericultural Science (Daejeon city, South Korea; 11-12th May, 2022), p. 38.
2. 김현복, 차익섭, 이지혜, 권해용, Kamidi Rahul, 최정숙 (2022) 품종(계통)별 오디의 과실적 특성 및 기능 성분 함량 비교. The 65th (1) Conference of the Korean Society of Sericultural Science (Daejeon city, South Korea; 11-12th May, 2022), p. 40.
3. 이지혜, Kamidi Rahul, 김현복, 권해용 (2022) 누에번데기 종류와 추출용매에 따른 항염증 효능 분석. The 65th (2) Conference of the Korean Society of Sericultural Science (Jeju Island, South Korea; 12-14th October, 2022), p. 88.
4. 김현복, 이지혜, Kamidi Rahul (2022) HME-DDS 기술을 적용한 꿀가루 제조 및 특성. The 65th (2) Conference of the Korean Society of Sericultural Science (Jeju Island, South Korea; 12-14th October, 2022), p. 100.

Research Papers (National):

1. Harijan, Y., Deepika, K.U., Suresh, K., Chakravarty, D., Pappachan, A. and Kishor Kumar, C.M. (2023). Assessment of polycross hybrids of mulberry for fruit and seed traits. *The Mysore Journal of Agricultural Sciences.* 57(2) [Accepted for publication].
2. Kabiraj, D., Chetia, H., Nath, A., Sharma, P., Mosahari, P. V., Singh, D., Dutta, P., Neog, K. and Bora, U. (2022). Mitogenome-wise codon usage pattern from comparative analysis of the first mitogenome of *Blepharipa* sp. (Muga uzifly) with other Oestroid flies, *Scientific Reports* (2022) 12:7028.https: //doi.org/ 10.1038/ s41598-022-10547-8.
3. Makwana, P., Shambhavi, P., Hungund, Appukuttan Nair and Pradeep, A.R. (2022). Dipteran endoparasitoid *Exorista bombycis* utilizes antihemocyte components against host defense of silkworm *Bombyx mori*. *Archives of Insect Biochemistry & Physiology*. https://doi.org/ 10.1002/arch.21976; (IF.2.454)
4. Mandal, A. K., Sarkar, B., Mandal, H., Chakraborty, A. P., Das Mohapatra, P. K., Dam, P., Mondal, R., Some, S., Sadat, A., Ghati, A., Neog, K., Mandal, S., Incei, I. A. (2022). Genomic Clues of a Multidrug-Resistant Bacterium from Cultured Domestic Silkworm (*Bombyx mori* L.), *Microbiology Resource Announcements,* May, 2022, DOI: 10.1128/ mra. 00081-22.
5. Raju, C.G., Sarkar, S., Canamedi, V., Parameswaranaik, J. and Sarkar, S. (2022). A review paper on Silkworm farming automation using Artificial Intelligence, Machine Learning and Cloud Based solutions. *Communications in Computer and Information Science* (CCIS), *Springer publication*. (Article accepted).

6. Suresh, K. Manjappa, G., and Kishor Kumar, C.M. (2022). Broad sense heritability and multivatiate analysis of powdery mildew resistant inter-specific pseudo F2 (F1) population of mulberry, *IV International conference on Innovative and Current Advances in Agriculture & Allied Sciences*, 12-14 June, Shimla, p.129.
7. Suresh, K. Deepika U.K., Harijan, Y. and Kishor Kumar, C.M. (2022). Adaptation to climate change effects by pruning and rearing date selection for mulberry sericulture in lower-gangetic region, National seminar on Climate Smart Sericulture: *Approaches for Sustainable Sericulture*, 6th & 7th October, p.60.
8. Tulsi Naik, K.S., Ismail, S., Pradeep, A.R. and R.K Mishra (2022). Molecular characterization of the functional genes associated with silk assembly, transport and protection in the silk glands of popular multivoltine breeds of silkworm *Bombyx mori* L. *Applied Biochemistry and Biotechnology*, *https:*//doi.org/10.1007/ s12010-022-04158-2 (IF 3.094).

Popular articles:

1. Kartik Neog and Kishor Kumar, C.M. (2022). Participation of Tribal populations on the Mulberry Silk Production in Assam. *Indian Silk.*

Books/ Book chapters/ Hand Book

1. পরমেশ্বর নাইক জে**,** শফি আফরোজ**,** দীপেশ পণ্ডিত**,** নেহা হোড়**,** সুস্মিতা দেবী**,** কিশোর কুমার**,** সি এম**.** (2023). কৃষক হস্ত পুস্তক রেশম চাষে শিল্প উদ্যোগ উন্নয়ন (Bengali). কেন্দ্রীয় রেশম গবেষণা ও প্রশিক্ষণ প্রতিষ্ঠান**,** কেন্দ্রীয় রেশম বোর্ড**,** বস্ত্র মন্ত্রণালয়**,** ভারত সরকার**,** বহরমপুর**,** মুর্শিদাবাদ**,** পশ্চিমবঙ্গ - 742101**,** ভারত**.**
2. Parameswaranaik, J. and Misha Madhavan, M. (2022). Entrepreneurship Development in Allied Sectors of Agriculture. *Skills for Entrepreneurship Development in Pig Husbandry* [E-book]. ICAR-National Research Centre on Pig, Rani, Guwahati & National Institute of Agricultural Extension Management, Hyderabad.
3. Parameswaranaik, J., Shafi, A., Dipesh, Pandit, Sushmita, D., Neha, H. and Kishor Kumar C. M. (2023). Farmers Hand Book on Entrepreneurship Development in Sericulture (English). Central Sericultural Research and Training Institute, Central Silk Board, Ministry of Textiles, Govt. of India, Berhampore, West Bengal-742101.
4. Sivaprasad, V., Chandrakanth, N. and Manthira Moorthy, S. (2022). Genetics and genomics of Bombyx mori L., *In Genetic methods and tools for managing crop pest*s edited by AK Chakravarthy, Part II published by Springer Nature Singapore, pp. 127-209.
5. Saha, S., Khasru, A., Tanmay C. and Pathadeb, G. (2022). Micropropagation for stress tolerance in crop plants: *An Overview in book Response of Field Crops to Abiotic stress* Edited by Shuvasish Choudhury and Debojyoti Moulick. CRC press, Taylor and Francis Group, https:// doi.org/ 10.1201/ 9781003258063.
6. Afroz, S. and Joycy, R. D. (2022). "Open Auction System in Silkworm Cocoon Markets" in the book '*Advances in Agricultural Marketing and Value Chain Management'* published by 'International Books & Periodical Supply Service' (ISBN : 978-93-94023-15-4; E-ISBN : 978-93-94023-16-1)
7. Rahul, K., Makwana, P., Ghosh, S. and Pappachan, A. (2022). Why biotechnology needed in insects? In: Kumar D. and Shukla S (eds). *Introduction to insect biotechnology,* Springer Nature Switzerland. (Accepted).

Papers Presented in Conferences/Seminars/Symposia *etc.* (Online)

Proceedings of The 65th (1) International Conference of the Korean Society of Sericultural Science (Daejeon city, South Korea) during 11th & 12th May, 2022.

1. Rahul, K., Kim, H.B., Kweon, H.Y., Lee, J.H. (2022). Anti-skin aging and antioxidant properties of silkworm (Baegokjam) pupal extracts. p. 19.
2. Rahul, K., Lee, J.H., Kim, H.B., Kweon, H.Y. (2022). Molecular weight distribution and structural characterization of fibroin isolated from diverse Korean silkworm varieties, p. 56.

Proceedings of IVth International Conference on innovative and current advances in agriculture and allied sciences (ICAAAS-2002) organized by SSDAT MEERUT at Shimla, Himachal Pradesh during 12-14th June, 2022.

1. Suresh, K., Manjappa, G., and Kishor Kumar, C.M. (2022). Broad sense heritability and multivatiate analysis of powdery mildew resistant inter-specific pseudo F2 (F1) populationof mulberry, p.129.

Proceedings of 26th International Sericulture Congress, SERITECH-The new concepts in sericulture during 7th to 11th September, 2022 at Cluj Napoca, Romania.

1. Alam, K., Paik, J., Saha, S., Rabha, M. and Sivaprasad, V. (2022). A preliminary investigation on image-based cocoon gender identification using deep convolution neural network, p. 129.
2. Makwana, P., Rahul, K., Pradeep, A.R., Niranjan, V., Sivaprasad, V., Kishor Kumar, C.M. (2022). Potential of sericin peptides from Bombyx mori (Nistari) as drug delivery molecules: A computational analysis. p. 270.
3. Raviraj, V.S., Makwana, P., Chandrakanth, N., Lakshmanan, V., Pradeep, A.R., Kishor Kumar, C.M. and Sivaprasad, V. (2022). Expression profiling of TRP genes for determination of thermo sensitivity and humidity tolerance in silkworm, Bombyx mori L. p. 184.
4. Makwana, P., Ito, K., Rahul, K., Raviraj, V.S., Pradeep, A.R., Sivaprasad, V., Kishor Kumar, C.M. (2022). Differential immune responses against Staphylococcus aureus infection in geographically distinct strains of Nistari (Bombyx mori), pp. 140-141.
5. Suresh, K., Ghosh, M. K., Chakravarty, D. and Kishor Kumar, C.M. (2022). Development and identification of nutrient use efficient mulberry genotypes for low input sericulture, p.95.
6. Tulsi Naik, K.S., Vanitha, C., Raghavender, G., Ramesha, A., Rabha, M., Rahul, K., Ranjini, M.S., Ponnuvel, K.M., Sivaprasad, V. (2022). Molecular marker assisted breeding for the development and evaluation of BmBDV/ BmDNV2 resistant productive commercial hybrids, pp. 123-124.
7. Manudeep Rao, D., A, Ramesha, Suresh K., R, K. Mishra, and K.M. Ponnuvel (2022). Identification, Expression analysis and Non-functional mutations in MLO genes associated with powdery mildew resistance in *Morus* spp. p.100.
8. Deepika K.U. (2022). Determining the effect of plant hormones, nutrients & bioactive substances in improving mulberry leaf longevity
9. Chandrakanth, N. (2022). An Improved Crossbreed, 12Y x BFC1 for Eastern & North Eastern India.

Proceedings of Vth regional science congress of West Bengal held on Panchanan Barma University, Cooch Behar, during 17th & 18th January, 2023.

1. Ghosh, S., Makwana, P., Rahul, K. (2023). Evaluation of antimicrobial and antioxidant properties of crude protein extract from mulberry (*Morus* sp.) leaves. p. 46.

Proceedings of International Conference on Advances in Plants, Microbes and Agricultural Sciences" (APMAS-2023) held during 2nd to 4th March, 2023.

1. Ghosh, S., Makwana. P., Mandal. P., Bhandari. J.B., Rahul.K.(2023).Assessment of antioxidant enzyme activities of crude and semi-purified protein extracts from mulberry leaves. APMAS/203/699. (Abs.)

Proceedings of National Seminar on "Climate Smart Sericulture-2022 approaches for sustainable Sericulture" organised by Central Silk Board, Bengaluru, India during 6th to 7th Oct., 2022.

1. Alam, K., Deepika, K. U., Chacroborty, S., Pandit, D. and Kishore Kumar, C. M. (2022). Survey on the occurrence of major foliar diseases of mulberry in Murshidabad district of West Bengal.
2. Chakrabarty, S., Ranjita Devi, Th., Dutta Biswas, T., Bindroo, B.B. and Kishor Kumar, C.M. (2022). Problems and prospects of Seed Cocoon (Nistari and SK6 x SK7) generation in West Bengal, p.22.
3. Chandrakanth, N., Roy, S., Moorthy, S.M., Raviraj, V.S., Sivaprasad, V. and Kishor Kumar, C.M. (2022). Functional classification of esterases in mulberry silkworm breeds popular in Eastern and North-Eastern India, p. 35.
4. Chandrakanth, N., Raviraj, V.S., Moorthy, S.M., Sivaprasad, V., Manjunatha, G.R. and Kishor Kumar, C.M. (2022). A new thermo-tolerant bivoltine double hybrid, WBDH-1 for Eastern and North-Eastern India, p. 21.
5. Kartik Neog and Kishor Kumar, C.M. (2022). Problems and Prospects of Bivoltine Sericulture in Nagaland.
6. Makwana, P., Ghosh, S., Rahul, K., Mandal, P., Pradeep, A.R., Sivaprasad, V. and Kishor Kumar, C.M. (2022) Identification of a new infective species of Serratia in mulberry silkworm, Bombyx mori, p. 100.
7. Maheswari, M., Lokesh, G., Chaudhuri, R.S., Chandrakanth, N., Murali, Y Srinivasulu and Sreenivasa, B.T. (2022). Evaluation and identification of silkworm (Bombyx mori L.) genetic resources for abiotic stress condition, p. 23.
8. Parameswara, N. J. (2022). Vulnerability of sericultural farmers against climate change in West Bengal. (Abs.)
9. Rabha, M., Rahul, K., Alam, K., Pradeep, A.R. and Kishore Kumar, C. M. (2022). Trends in diseases incidence in commercial crops during favourable and unfavorable seasons in West Bengal, p.92.
10. Raviraj, V.S., Chandrakanth, N., Sivaprasad, V., Moorthy, S.M., Pradeep A.R. and Kishor Kumar, C.M. (2022). Identification of potential parental breeds for development of bivoltine double hybrids tolerant to high temperature and high humidity for Eastern and North Eastern India, p. 20.
11. Ranjta, D. Th., Chakrabarty, S., Mitra, G. and Kishor Kumar, C.M. (2022). Cold reeling - an agent of selection in breeding programme of Nistari-a multivoltine breed in sericulture, p. 138
12. Srinivasa. G, Manjunatha, G.R. Shafi Afroz, Dipesh Pandit and Kishor Kumar, C.M. (2022). Integratation of reeling activity with cocoon production for increasing the farmers' income in WB.
13. Suresh, K., Chattopadhayay, S., Deepika, U.K., Harijan, Y. and Kishor Kumar, C.M. (2022). Development of powdery mildew resistant mulberry genotypes and evaluation for leaf productivity under sub-tropical irrigated condition, p. 106.

14. Suresh, K., Deepika, U.K., Harijan, Y. and Kishor Kumar, C.M. (2022). Adaptation to climate change effects by pruning and rearing date selection for mulberry sericulture in lower-gangetic region, p.62.

Proceedings of National Seminar on Entrepreneurship in Sericulture at SK University Anantapur on 28th and 29th April, 2022.

1. Balachandran, N., Collins, Z. Renthlei and Kishor Kumar, C.M. (2022). Impact of Integrated Sericulture Development Programme under NERTPS in the North Eastern state of Meghalaya in improving socio economic status of the mulberry sericulturists. p.105.

Proceedings of National conference on "Sericulture based multidisciplinary approaches for climate resilience sustainability & livelihood security" organized by College of Sericulture, Chintamani, UAS Bengaluru during 26th to 27th August, 2022.

1. Yallappa Harijan, Suresh. K., Deepika K.U., Chakravarty, D., Pappachan, A.l and Kishor Kumar, C.M. (2022). Characterization of hybrid fruits & seeds of mulberry from polyclonal seed orchard. p. 17.

Proceedings of National Symposium on "Vanya Sericulture: Opportunity Galore" organized by CTR&TI, Ranchi at Ranchi on 28th & 29th October, 2022

1. Alam, K., Raviraj, V.S., Kar P. K. and Chakraborty, S. (2022). Diversity in wild tasar (Antheraea mylitta D.) ecoraces of Simlipal biosphere reserve with respect to cocoon and associated parameters, p. 126.
2. Zakir Hossain and Kishore Kumar, C.M. (2022). Exploitation of hilly regions of West Bengal to augment muga seed production in the North Eastern region of India, p.143.
3. Gogoi, D.K. and Bhuyan, P.M. (2022). Exploration of gut bacterial diversity and community structure in Muga silkworm, Antheraea assamensis Helfer in Northeast India, p. 104.
4. K. Neog, Singh, B.K. and Kishore Kumar, C.M. (2022). Seri-Biodiversity in Nagaland, p. 124.

Proceedings of Rajbhasha Takniki Seminar on Samagra Resham Utpadon Chunotiya ebom bhabi rononeeti organized by Central Tasar Research & Training Institute, Central Silk Board, Ranchi on 28th January 2023.

1. Alam, K., Kire, Z., Pandit, D. and Kishor Kumar, C.M. (2023). Sahatut safed makkhi ke khilaf joibik niontron agent ke rup me chrysoperla sp ka field mulyankon. Rashtriya.
2. Deepika, K.U., Harijan, Y., Alam, K., Suresh, K. and Kishor Kumar, C.M. (2023). NDBI bisleshak dwara sahatut poudha ke swastha ka parimanikaran.
3. Kishor Kumar, C.M. (2023). Bharat ke purbi aur purbottar rajyo me shahatut resham Krishi ke vikash me CSRTI, Berhampore ka jogdan.
4. Paik, J., Saha, S., Rabha, M. and Sivaprasad, V. (2022). A Sahatut safed makkhi ke khilaf joibik niontron agent ke rup me chrysoperla sp ka field mulyankon.
5. Raviraj, V.S., Sonowal, A., Hussain, A., Devi, S., Chandrakanth, N., Makwana, P., Alam, K., Pradeep, A. R. and Kishor Kumar, C.M. (2023). Resham keet *Bombyx mori* me marker sahayak Chayan ka upoyog karke uchha tapman aur adrta ke liye sahisnu bivoltine ka pehechan.
6. Suresh, K., Harijan, H., Deepika, K.U., Chattopadhyay, S. and Kishor Kumar, C.M. (2023). Sharat ritu ke dauran parna ebang resham kosa ki utpadakata hetu shahatut ke naya jeenrup ka akalan.

Scientists participated on Training/ guest lecture:

#	Name of the Scientists/ Officials	Title of the programme	Place & Duration
1.	Dr. N. Chandrakanth, Scientist-C	CRISPR/Cas based molecular diagnostics	Organised by Tamil Nadu Veterinary and Animal Sciences University, Chennai during 9 th to 13th May, 2022.
2.	Dr. N. Chandrakanth, Scientist-C	Molecular taxonomy-DNA barcodes	E-workshop on conducted by Biosristhti, India during 2nd to 6th May, 2022
3.	Dr. N. Chandrakanth, Scientist-C	Protein structure prediction & Molecular docking studies in bioscience research	E-workshop on conducted by Quaxon Bio & IT solutions, India during 22nd & 23rd Dec., 2022.
4.	DR. Kartik Neog, Scientist-D	Nursery raising techniques of Som, Chandan and Agar	A training on organized by KVK, Teok, Jorhat on 2nd August, 2022.
5.	DR. Kartik Neog, Scientist-D	Farmers' Skill Training Programme on Muga and Eri Culture	A training organized by CMER&TI, Lahdoigarh at CTC, MAC, Merdebera Gaon, Dhemaji, Assam on 30th Nov., 2022.
6.	Dr. Yallappa Harijan, Scientist-C	Geo tagging mobile App for CSB assets	Hands on training jointly organized by BTSSO, Bilaspur and NESAC Meghalaya at Bilaspur on 8th Dec., 2022.
7.	Mr. Khasru Alam, Scientist-C	Geo tagging mobile App for CSB assets	Hands on training jointly organized by BTSSO, Bilaspur and NESAC Meghalaya at Bilaspur on 8th Dec., 2022.
8.	Dr. A. R. Pradeep, Scientist D	Faculty development training	Organised at CSR&TI, Berhampore on 4th February, 2023
9.	Dr. Pooja Makwana, Scientist C	Faculty development training	Organised at CSR&TI, Berhampore on 4th February, 2023
10.	Dr. Raviraj V.S., Scientist C	Faculty development training	Organised at CSR&TI, Berhampore on 4th February, 2023
11.	Dr. Mihir Rabha, Scientist C	Hands on training on molecular techniques applied in the field of Sericulture	Organized by SBRL-Kodathi during 14th to 23rd November, 2022
12.	Dr. Deepika, K.U., Scientist C	Hands on training on molecular techniques applied in the field of Sericulture	Organized by SBRL-Kodathi during 14th to 23rd November, 2022
13.	Dr. Suresh, K., Scientist-C	Recent trends in sustainable livestock and crop production technologies vis-à-vis climate change	21 days online training programme during 18th June to 8th July, 2022 by ICAR-IGFRI, Srinagar
14.	Dr. Suresh, K., Scientist-C	Drones for Agriculture Development	Organised by MANAGE during 11th to 15th July, 2022
15.	Shri Bimal Chaudhuri, Sr. Tech. Asst.	Hands on training on soil and leaf analysis	Organised by CSR&TI, Mysore during 9th to 18th January, 2023

PAMPHLETS/ BOOKLETS (Bengali/Hindi/English) 2022-23

Pamphlets:

Suresh, K., Chattopadhyay, S., Yallappa, H., Deepika, K.U., Chatterjee, S. and Kishor Kumar, C.M. (2023). 'GANGA: Powdery mildew resistant mulberry variety for irrigated & rainfed conditions' (English/ Hindi/ Bengali). CSRTI, Berhampore, **Pamphlet No.113.**

Suresh, K., Ghosh, M. K., Chatterjee, S. and Kishor Kumar, C.M. (2023). 'RATNA: Mulberry variety for red lateritic soils and low input condition' (English/ Hindi/ Bengali). CSRTI, Berhampore, **Pamphlet No.114.**

Suresh, K., Chakraborthy, S., Yallappa, H., Deepika, K.U., Chatterjee, S. and Kishor Kumar, C.M. (2023). 'Mulberry cultivation technology for Chawki garden' (English/ Hindi/ Bengali). CSRTI, Berhampore, **Pamphlet No.115.**

Shafi Afroj, Parameshwar, Naik, Manjunath, G.R., Khasru Alam, Dipesh Pandit, Srinivasa, G. and Kishor Kumar, C.M. (2023). Handbook on Commercial Chawki Rearing in West Bengal (English and Bengali)

Posters:

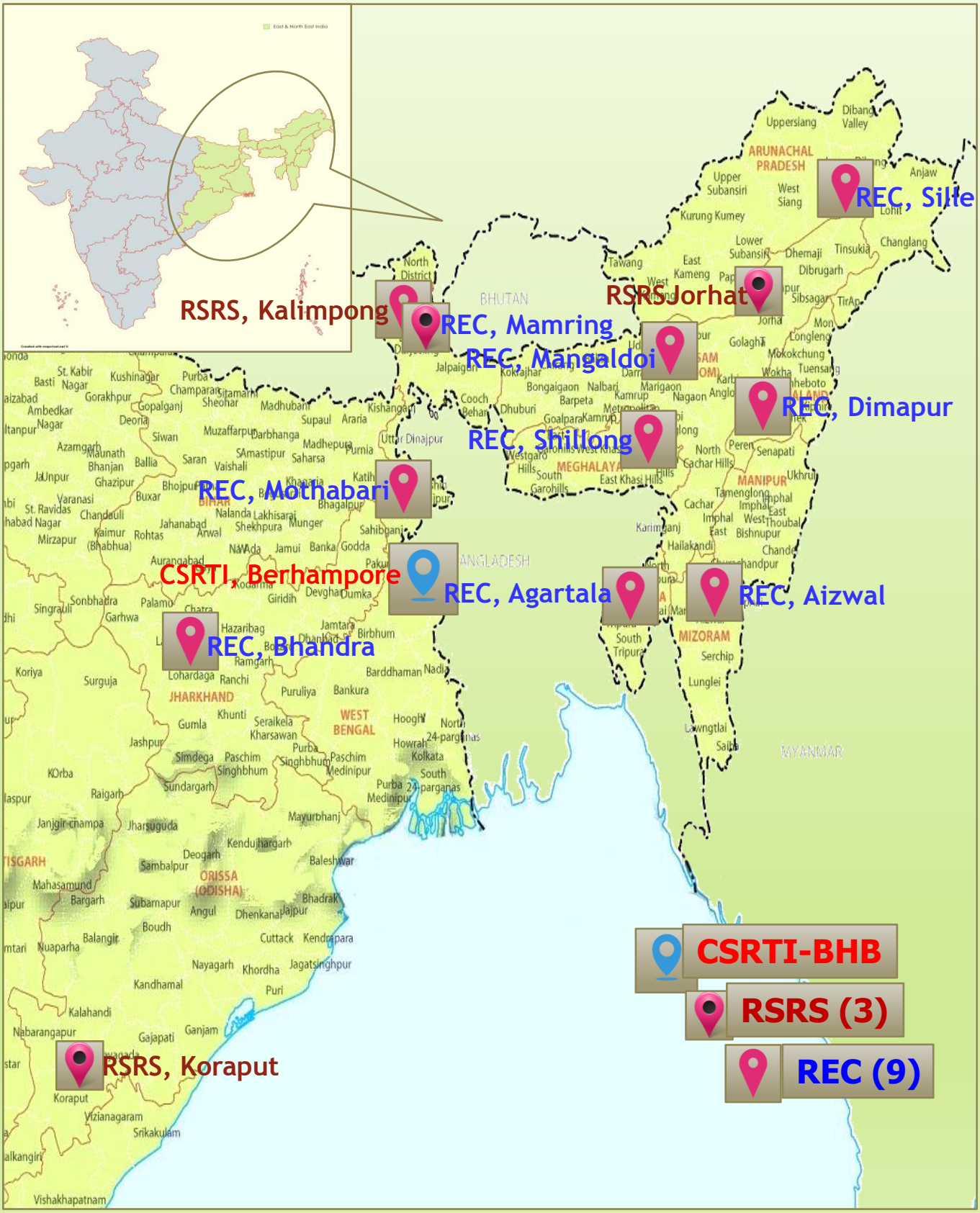
i) WB1HH
ii) Polu Pokar Rog o Sayasthyapana
iii) Chaki palaner Arthaniti
iv) Banijik Chawki Palan

METEOROLOGICAL DATA

Months	CSRTI-Berhampore(WB)						RSRS-Jorhat						RSRS-Koraput					
	Temp (°C)		RH%		Rainfall		Temp (°C)		RH%		Rainfall		Temp (°C)		RH%		Rainfall	
	Max	Min.	Max	Min.	mm	Days	Max	Min.	Max	Min.	mm	Days	Max	Min.	Max	Min.	mm	Days
Apr,22	42.0	23.6	75.1	65.6	15	2	30	19	91	40	34	14	34.4	19.5	84	27	41	4
May,22	38.0	21.6	81.0	70.8	113	10	34	19	84	29	32	14	39.0	19.0	78	33	8	1
Jun,22	37.6	25.2	82.1	76.1	70	7	32	23	92	51	58	17	33.5	22.1	92	39	79	6
Jul,222	38.0	25.0	88.1	81.3	151	9	36	23	78	68	61	12	29.7	21.3	100	70	317	23
Aug,22	36.4	25.6	87.8	82.1	138	10	35	22	93	46	23	8	29.5	21.3	100	64	427	18
Sep,22	36.6	25.0	90.4	84.4	207	16	35	24	62	56	98	21	28.9	21.2	100	69	315	15
Oct,22	34.6	21.0	85.4	76.6	16	3	34	18	85	29	69	17	27.1	15.6	100	52	253	7
Nov,22	32.0	13.6	83.3	75.4	14	2	32	14	93	15	-	-	26.1	13.3	100	33	27	1
Dec,22	29.2	10.0	82.8	75.4	2	1	30	12	50	10	2	1	25.8	12.3	91	31	1	1
Jan,23	28.0	9.0	81.4	73.2	0	0	28	10	25	10	2	1	25.6	10.5	91	31	-	-
Feb,23	34.8	11.4	74.4	62.5	0	0	29	14	47	15	2	1	29.6	13.3	90	15	-	-
Mar,23	35.2	16.0	73.9	62.9	71	6	33	16	81	16	9	4	30.6	17.2	91	21	85	3
Total					797	66					380	110					1554	79
Months	RSRS-Kalimpong						REC-Mothabari						REC-Dimapur					
	Temp (°C)		RH%		Rainfall		Temp (°C)		RH%		Rainfall		Temp (°C)		RH%		Rainfall	
	Max	Min.	Max	Min.	mm	Days	Max	Min.	Max	Min.	mm	Days	Max	Min.	Max	Min.	mm	Days
Apr,22	29	15	100	48	-	-	42	23	91	30	63	6	31.3	17.4	72.8	56.2	27	-
May,22	31	16	99	42	-	-	44	25	93	32	183	12	76.2	61.5	31.3	18.1	36	-
Jun,22	31	19	100	51	-	-	45	24	90	59	62	6	84.1	67.1	32.4	24.8	12	-
Jul,222	34	20	100	41	-	-	36	24	86	58	58	5	34.0	25.0	93.0	78.0	21	-
Aug,22	32	21	100	52	-	-	33	24	89	61	12	3	33.9	25.4	90.3	77.9	19	-
Sep,22	32	19	100	45	-	-	31	25	93	68	270	16	32.4	24.6	89.0	78.6	99	-
Oct,22	32	14	100	25	-	-	29	22	85	60	13	3	32.4	24.8	88.2	77.7	-	-
Nov,22	31	13	100	25	-	-	27	17	71	53	-	-	30.3	19.2	83.2	73.8	-	-
Dec,22	26	7	100	28	-	-	24	13	75	62	18	2	22.4	12.9	82.6	32.4	6	-
Jan,23	24	6	95	31	-	-	23	12	72	57	-	-	24.4	11.6	74.7	60.8	3	-
Feb,23	22	4	100	27	-	-	26	14	75	51	21	5	28.3	13.7	72.2	59.0	15	-
Mar,23	30	14	99	25	-	-	34	22	88	35	10	1	30.2	16.2	67.6	58.2	-	-
Total											709	59					239	
Months	REC-Agartala						REC-Shillong						REC-Aizwal					
	Temp (°C)		RH%		Rainfall		Temp (°C)		RH%		Rainfall		Temp (°C)		RH%		Rainfall	
	Max	Min.	Max	Min.	mm	Days	Max	Min.	Max	Min.	mm	Days	Max	Min.	Max	Min.	mm	Days
Apr,22	34	18	87	70	30	-	25.6	12.0	89	35	3	1	30	15	95	30	53	-
May,22	34	22	92	71	196	-	24.9	14.0	91	68	10	2	32	16	94	35	73	-
Jun,22	32	23	96	78	305	-	25.1	17.9	93	64	8	2	31	17	98	45	401	-
Jul,222	34	23	92	78	123	-	26.0	18.0	92	62	178	9	29	17	100	50	355	-
Aug,22	32	24	92	76	121	-	25.0	14.2	89	62	666	24	31	19	98	50	460	-
Sep,22	33	26	96	79	63	-	25.0	16.0	92	69	821	23	31	19	95	50	278	-
Oct,22	31	24	96	72	72	-	26.5	12.0	92	60	221	16	27	16	96	45	355	-
Nov,22	30	19	92	68	0	-	23.0	10.0	92	50	208	11	29	17	100	50	211	-
Dec,22	27	14	95	68	0	-	17.0	4.0	91	55	213	15	30	16	95	48	158	-
Jan,23	25	11	90	54	0	-	15.0	3.0	89	54	65	6	25	12	88	40	18	-
Feb,23	25	13	91	53	0	-	18.0	5.0	88	35	-	-	26	10	68	36	0	-
Mar,23	32	19	91	51	26	-	20.0	9.0	85	45	-	-	29	13	90	30	78	-
Total					936	-					2394	109					2442	

CSRTI-BERHAMPORE

Extension Network



CSRTI-Berhampore, CSB, WB

Annual Report 2022-23

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