

ISBN: 978-81-972337-8-4



वस्त्र मंत्रालय
MINISTRY OF
TEXTILES



वार्षिक प्रतिवेदन ANNUAL REPORT 2023-2024



केन्द्रीय मूगा एरी अनुसंधान व प्रशिक्षण संस्थान
Central Muga Eri Research and Training Institute
केन्द्रीय रेशम बोर्ड Central Silk Board

वस्त्र मंत्रालय, भारत सरकार Ministry of Textiles, Govt. of India
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के. रे. बो. - के.मू.ए.अ.व.प्र.स. की वर्ष २०२३-२४ की वार्षिक प्रतिवेदन
Annual Report 2023-24 of CSB-CMER&TI

प्रकाशन का वर्ष: जुलाई, 2024

Year of publication: July, 2024

ISBN: 978-81-972337-8-4

प्रकाशक Published by:

निदेशक, के.मू.ए.अ.व.प्र. Director, CMER&TI

केन्द्रीय रेशम बोर्ड Central Silk Board

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श्री सिंटो एंटो, वैज्ञानिक-बी Sh. Sinto Antoo, Scientist-B

हिन्दी अनुवाद Hindi Version

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द्विभाषी (हिंदी और अंग्रेजी): 50 प्रतियां

Bilingual (Hindi & English): 50 Copies





Our Vision

To emerge as an international research institute of excellence for muga, eri and oak tasar culture to ensure higher productivity and growth in sericulture

Our Mission

To achieve excellence in application oriented research for transforming the Muga, Eri and Oak Tasar industry from the subsistence level of production to a vibrant commercial base





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प्रस्तावना

जैसे-जैसे हम अपनी पिछली उपलब्धियों की समृद्ध चित्रपट द्वारा निर्देशित और नवाचार के वादे से प्रेरित होकर भविष्य की ओर बढ़ रहे हैं, मुझे इस संस्थान की वर्ष 2023-24 की वार्षिक रिपोर्ट प्रस्तुत करते हुए मुझे बेहद खुशी हो रही है। संस्थान के दो दशकों के अस्तित्व पर प्रतिबिंबित करते हुए, हम पूर्वोत्तर भारत में वन्या रेशम उत्पादन के इतिहास में अपनी भूमिका पर गर्व करते हैं। इस वर्ष में संस्थान ने कई महत्वपूर्ण मील के पत्थर और सफलताएं देखी हैं, जो विशेष रूप से हमारे देश के पूर्वी और पूर्वोत्तर क्षेत्रों में रेशम उत्पादन की उन्नति के लिए हमारी अटूट प्रतिबद्धता को रेखांकित करता है। अनुसंधान और विकास में उत्कृष्टता की हमारी अथक खोज ने न केवल रेशम उत्पादन परिदृश्य को समृद्ध किया है, बल्कि इस दौरान अनगिनत किसानों और हितधारकों को भी सशक्त बनाया है। क्षेत्र में कई तकनीकों और प्रौद्योगिकियों को विकसित किया गया और प्रभावी ढंग से लागू किया गया। इस मोड़ पर, मैं संस्थान के समर्पित वैज्ञानिकों और सहायक कर्मचारियों के साथ-साथ उन हितधारकों की भी हार्दिक सराहना करता हूँ जिन्होंने इन नवीन तकनीकों और प्रौद्योगिकियों को अपनाया। इस सामूहिक प्रयास के कारण ही हमने मूगा, एरी और ओक तसर क्षेत्रों में कच्चे रेशम के उत्पादन में महत्वपूर्ण वृद्धि देखी है।



खाद्य पादप सुधार, उत्पादन और संरक्षण के क्षेत्र में, बारहमासी अरंडी की किस्मों के संकरण कार्यक्रम में महत्वपूर्ण प्रगति हुई है, जिसमें 26 आशाजनक बारहमासी अरंडी जर्मप्लाज्म का चयन किया गया है। एरी रेशम के कीड़ों के लिए एक महत्वपूर्ण मेजबान पौधे, बोरपत के लिए नर्सरी तकनीकों को मानकीकृत और प्रलेखित किया गया है, जिससे किसान बोरपत नर्सरी स्थापित कर सकें। उन्नत मशीन लर्निंग तकनीकों का उपयोग ऊपरी ब्रह्मपुत्र घाटी के विस्तृत मृदा कार्बनिक कार्बन (एसओसी) मानचित्र बनाया और प्रकशित किया गया, जिससे मिट्टी की गुणवत्ता के आकलन में सहायता मिली। मूगा रेशमकीट पालन पर तुलनात्मक अध्ययन द्वारा सोम और सोआलू पौधों के इष्टतम संयोजन की पहचान हुई है। मूगा रेशमकीट और उनके मेजबान पौधे, सोम पर उच्च कार्बन डाईऑक्साइड और तापमान के प्रभाव से लाभकारी और प्रतिकूल दोनों प्रभाव सामने आए हैं। सोम पौधे के लिए वायु प्रदूषण सहनशीलता सूचकांक (APTI) का मूल्यांकन किया गया, जिससे इसकी लचीलापन के बारे में जानकारी मिली और मूगा रेशम उत्पादन के लिए प्रदूषण शमन रणनीतियों की जानकारी भी प्राप्त हुई। इसके अतिरिक्त, बोरपत के लिए क्लोनल प्रसार तकनीक विकसित करने के लिए ICFRE-RFRI के साथ एक सहयोगी परियोजना की शुरुआत की गई।

रेशमकीट सुधार, उत्पादन और संरक्षण के क्षेत्र में हमारे संस्थान की उपलब्धियाँ समान रूप से सराहनीय हैं। जिसमें एरी रेशमकीट के अंडे सेने के लिए ब्लैक बॉक्सिंग शेड्यूल को अपनाकर अधिकतम हैचिंग दर और कम मृत्यु दर प्राप्त हुआ, जबकि बड़े पैमाने पर एरी खुले अंडा उत्पादन तकनीक ने दक्षता और मापनीयता को बढ़ाया। एरी और मूगा रेशमकीट को प्रभावित करने वाली नोसेमा प्रजातियों की पूर्ण जीनोम अनुक्रमण ने पारंपरिक अंडा उपचार विधियों के लिए एक व्यवहार्य विकल्प को पहचान मिली। पेन्निन रोग का पता लगाने के लिए कृत्रिम बुद्धिमत्ता (एआई) का उपयोग करने वाला एक मोबाइल ऐप को विकसित किया गया था, और एरी रेशमकीट सुधार के लिए आशाजनक संकर संयोजनों के साथ उच्च प्रजनन क्षमता वाली पीढ़ियों की पहचान की गई थी। मूगा सुपर कुक फॉर्मूलेशन को अपनाकर यह पाया गया कि मूगा कोकून रीलिंग के प्रदर्शन में अत्यधिक सुधार एवं सुविधा मिली। गैर-पारंपरिक क्षेत्रों में मूगा रेशमकीट पालन पर किए गए अध्ययनों ने पूर्वोत्तर से परे पालन क्षेत्रों के विस्तार की मे उपलब्धि प्राप्त हुई। इसके अतिरिक्त, ओक तसर रेशमकीट ए. प्रोलेई पतंगों में अंडे देने को उत्तेजित करने वाले रासायनिक संकेतों की पहचान की गई, और ओक तसर रेशमकीट की एक ताप-सहिष्णु श्रेणी विकसित की गई।

उल्लेखनीय है कि भारत टेक्स-2024 के दौरान विकसित ये साझेदारियाँ रेशम उत्पादन क्षेत्र में नवाचार और ज्ञान के आदान-प्रदान को आगे बढ़ाने में सहायक हैं। जिसके तहत सीएसबी-सीएमईआरएंडटीआई ने अपने शोध एवं विकास सहयोग



को काफी मजबूत किया तथा इसको और आगे बढ़ाने के लिये वर्षा वन अनुसंधान संस्थान (आईसीएफआई-आरएफआईआई) और कल्याण फाउंडेशन, गुजरात जैसे प्रतिष्ठित संस्थानों के साथ समझौता ज्ञापन पर हस्ताक्षर किए हैं। प्रौद्योगिकी हस्तांतरण में हमारे प्रयासों को अनदेखा नहीं किया जा सकता है, प्रशिक्षण कार्यक्रमों से मूंगा आदिवासी किसानों को लाभ मिला है, जिससे कोकून उत्पादन और कुल आय में उल्लेखनीय वृद्धि हुई है। इसके अतिरिक्त, वन्य रेशम कृषि मेला, कार्यशालाएँ, प्रदर्शनीयाँ, क्षेत्र दिवस और जागरूकता कार्यक्रम जैसे अनगिनत कार्यक्रमों की एक श्रृंखला ने ज्ञान के प्रसार और रेशम उत्पादन क्षेत्र में हितधारकों के सशक्तिकरण में योगदान दिया है। किसानों, शोधकर्ताओं और विभिन्न हितधारकों के साथ सहयोग हमारी सफलता के लिए महत्वपूर्ण रहा है। सीएसबी-सीएमईआरएंडटीआई की सहायक इकाइयों ने अपने उद्देश्यों की प्राप्ति के लिए सक्रिय रूप से प्रयास किया है। क्षेत्रीय रेशम उत्पादन अनुसंधान केंद्र (आरएसआरएस), इंफाल ने ओक तसर रेशमकीट पर केंद्रित अनुसंधान और विस्तार पहल करने में अग्रणी भूमिका निभाई है। क्षेत्रीय रेशम उत्पादन अनुसंधान केंद्र, बोको, निचले असम क्षेत्रों और पश्चिम बंगाल में रेशम उत्पादकों की आवश्यकताओं को पूरा करने के लिए समर्पित रहा है। क्षेत्रीय विस्तार केंद्र (आरईसी) ने वर्ष के लिए अपने लक्ष्यों को सफलतापूर्वक पूरा किया है, और किसानों को कोकून उत्पादन बढ़ाने में सहायता करने में महत्वपूर्ण भूमिका निभाई है।

मैं, अनुसंधान सलाहकार समिति के अध्यक्ष और सदस्यों के प्रति अपनी कृतज्ञता व्यक्त करना चाहती हूँ, जिन्होंने नई परियोजनाओं को शुरू करने और स्वीकृत परियोजनाओं के निर्बाध निष्पादन को सुनिश्चित करने में अमूल्य सहयोग और दृढ़ समर्थन दिया है। इसके अतिरिक्त, मैं सीएसबी-सीएमईआरएंडटीआई के विकास में उनके अटूट समर्थन के लिए केंद्रीय रेशम बोर्ड, बेंगलोर के सक्षम प्राधिकारी को भी अपना हार्दिक धन्यवाद देती हूँ। मैं सभी पूर्वोत्तर राज्यों में रेशम उत्पादन विभाग द्वारा किए गए सहयोगात्मक प्रयासों और समर्थन की ईमानदारी से सराहना करती हूँ, जो विकासात्मक और विस्तार संचार कार्यक्रमों के सफल कार्यान्वयन में सहायक रहा है। सहयोगी संस्थानों और अनुसंधान वित्तपोषण एजेंसियों का योगदान महत्वपूर्ण रहा है, और उनका समर्थन अत्यधिक मूल्यवान है।

जैसे-जैसे हम आगे बढ़ रहे हैं, रेशम उत्पादन अनुसंधान की सीमाओं को आगे बढ़ाने, तकनीकी प्रगति को बढ़ावा देने और हमारे द्वारा सेवा प्रदान किए जाने वाले क्षेत्रों के सामाजिक-आर्थिक विकास में योगदान देने के लिए हम प्रतिबद्ध हैं। मैं सभी हितधारकों को इस वार्षिक रिपोर्ट का अध्ययन करने के लिए आमंत्रित करती हूँ, जिसमें हमने जो प्रगति की है और भविष्य के विकास के लिए संभावित अवसरों को पहचाना है।

के. यम वि. कुमारी

(डॉ. के.एम. विजया कुमारी)
निदेशक



Foreword

As we stride into the future, guided by the rich tapestry of our past achievements and fueled by the promise of innovation, it gives me great pleasure to present the Annual Report of the Central Muga Eri Research & Training Institute (CMERTI) for the year 2023-24. As we reflect on the Institute's two decades of existence, we take pride in our role in the unfolding history of Vanya sericulture growth in Northeast India. This year has been marked by significant milestones and breakthroughs, underscoring our unwavering commitment to the advancement of sericulture, particularly in the eastern and northeastern regions of our country. Our relentless pursuit of excellence in research and development has not only enriched the sericulture landscape but has also empowered countless farmers and stakeholders along the way. Numerous technologies have been conceptualized, developed, and effectively implemented in the field. At this juncture, I extend my heartfelt appreciation to the dedicated scientists and supportive staff of the Institute, as well as the stakeholders who embraced and adopted these innovative techniques. It is through this collective effort that we have witnessed a substantial increase in raw silk production across the muga, eri, and oak tasar sectors.



In the domain of Host Plant Improvement, Production, and Protection, Significant strides have been made in the hybridization program for perennial castor varieties, selecting 26 promising perennial trait lines. Nursery techniques for Borpat, a crucial host plant for eri silkworms, have been standardized and documented, enabling farmers to establish Borpat nurseries. Advanced machine learning techniques were used to create detailed Soil Organic Carbon (SOC) maps of the Upper Brahmaputra Valley, aiding in soil quality assessments. Comparative studies on muga silkworm rearing identified the optimal combination of Som and Soalu plants. The impact of elevated CO₂ and temperature on muga silkworms and their host plant, Som, revealed both beneficial and adverse effects. The Air Pollution Tolerance Index (APTI) for Som was evaluated, providing insights into its resilience and informing pollution mitigation strategies for muga silk production. Additionally, a collaborative project with ICFRE-RFRI was initiated to develop clonal propagation techniques for Borpat.

In the realm of Silkworm Improvement, Production, and Protection, the development of a black boxing schedule for eri silkworm egg hatching achieved high hatching rates and low mortality, while a pioneering large-scale eri loose egg production technology enhanced efficiency and scalability. Complete genome sequencing of Nosema species affecting eri and muga silkworms identified a viable alternative to traditional egg treatment methods. A mobile app using AI for pebrine detection was developed, and high fecundity lines along with promising hybrid combinations for eri silkworm improvement were identified. The Muga super cook formulation significantly improved cocoon reeling performance. Studies on muga silkworm rearing in non-traditional regions showed potential for expanding rearing areas beyond the Northeast. Additionally, chemical cues





stimulating egg laying in *A. proylei* moths were identified, and a thermo-tolerant line of oak tasar silkworms was developed.

It is to mention that CSB-CMER&TI has significantly bolstered its research and development collaborations, forging Memorandums of Understanding with esteemed institutions such as the Rain Forest Research Institute (ICFRE-RFRI) and the Kalyan Foundation, Gujarat. These partnerships, fostered amid Bharat Tex-2024, are instrumental in advancing innovation and knowledge exchange within the sericulture sector.

Our efforts in technology transfer have not gone unnoticed, with training programs benefiting muga tribal farmers leading to a significant increase in cocoon production and overall income. Additionally, a series of events such as Vanya Resham Krishi melas, workshops, exhibitions, field days, and awareness programs have contributed to the dissemination of knowledge and the empowerment of stakeholders in the sericulture sector. The collaboration with farmers, researchers, and various stakeholders has been pivotal to our success. The subsidiary units of CSB-CMER&TI have actively pursued the realization of their individual objectives. RSRS, Imphal, has taken a lead role in conducting research and extension initiatives focused on oak tasar silkworms. RSRS, Boko, has been dedicated to serving the requirements of sericulturists in lower Assam and West Bengal. The RECs have successfully met their targets for the year, playing a crucial role in assisting farmers to enhance cocoon production.

I would like to express my sincere gratitude to the Chairman and members of the Research Advisory Committee for their invaluable input and steadfast support in initiating new projects and ensuring the seamless execution of approved projects. Additionally, I extend my heartfelt thanks to the Competent Authority of the Central Silk Board, Bangalore, for their unwavering support in the development of CSB-CMER&TI. I sincerely acknowledge and appreciate the collaborative efforts and support extended by the Department of Sericulture in all Northeastern states, which has been instrumental in the successful implementation of developmental and extension communication programs. The contributions from collaborating institutes and research funding agencies have been pivotal, and their support is highly valued.

As we move forward, we remain committed to pushing the boundaries of sericulture research, fostering technological advancements, and contributing to the socio-economic development of the regions we serve. I invite all stakeholders to explore this Annual Report, recognizing the strides we have made and the potential avenues for future growth.

(Dr. K. M. Vijaya Kumari)
Director





CMER&TI, LAHDOIGARH AT A GLANCE

Established by the Central Silk Board (CSB), Ministry of Textiles, Government of India in 1999, the Central Muga Eri Research & Training Institute (CMER&TI) stands as the premier research and development centre addressing the unique needs of the vanya sericulture industry in Northeast India. Located in Lahdoigarh, 16 km east of Jorhat, Assam, CSB-CMER&TI has been instrumental in advancing research and development activities focused on muga, eri, and oak tasar culture—a region known for its rich production of various vanya silks. The primary objective of CSB-CMER&TI is to innovate new technologies aimed at enhancing the productivity of muga, eri, and oak tasar silkworms, transforming traditional sericulture practices into profitable and sustainable enterprises. Over the years, the institute has bolstered its infrastructure to facilitate cutting-edge research in these frontier areas of Sericulture in the North Eastern Region of India.

The institute's scientists work collaboratively to develop farmer-friendly technologies, implement them in the field, evaluate their effectiveness, and disseminate them widely. Research and developmental activities are organized under six divisions, with a dedicated Project Monitoring Cell (PMC) overseeing institutional R&D planning and progress monitoring. Administrative functions at CSB-CMER&TI are managed by ten sections, including Establishment, Accounts & Billing, Stores and Purchasing, Library, Vehicle Maintenance, Construction, Labor Management, Computer Services, Hindi, and Receipt & Dispatch.

To ensure the effective transfer and validation of technologies developed by CSB-CMER&TI, two Regional Sericulture Research Stations (RSRS) have been established: RSRS Boko in Assam focusing on Muga-related research, and RSRS Imphal in Manipur dedicated to Oak Tasar. Additionally, three Research Extension Centers (RECs) located in strategic sericulture zones—Coochbehar (West Bengal) and Lakhimpur (Assam) for muga, and Fatehpur (Uttar Pradesh) for eri—support the identification of region-specific technologies and their dissemination to field practitioners. These regional stations and RECs play a crucial role in bridging the gap between laboratory findings and on-ground applications. Field Laboratory T. Khullen, under the purview of RSRS Imphal, focuses specifically on transferring technologies pertinent to Oak Tasar sericulture to beneficiaries. This concerted effort reflects CSB-CMER&TI's commitment to advancing vanya sericulture through research, technology transfer, and sustainable development initiatives.





MANDATE OF THE INSTITUTE

- To act as an apex Research Institute for providing R&D support for muga, eri and oak tasar sericulture.
- To conduct basic, strategic and applied research to increase production and productivity of silkworms and their host plants.
- Improvement of food plants and silkworm eco-races and hybrids.
- To conduct socio-economic research for assessing sustainability of newly developed technologies.
- To percolate the research findings to the end users through extension and training mechanism.

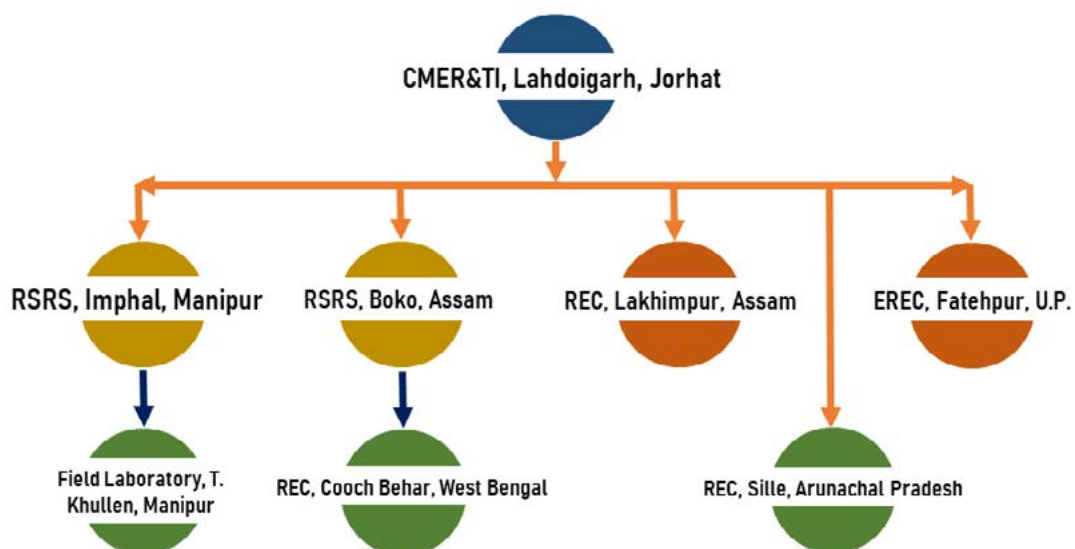
HUMAN RESOURCES (as of 31.03.2024)

Sl. No.	Staff	Main institute	RSRS (Boko+Imphal)	RECs
1	Scientists			
	Scientist-D	4	1+3	1
	Scientist-C	5	0+1	0
	Scientist-B	7	0	1
	Sub-Total	16	5	2
2	STA/ SFA/FA	13	3 +11 = 14	12
3	Administrative staff			
	AD (A&A)+AD (Com)+AD (OL)	0+1+1	0	0
	Supdt + Asst. Supt + JE	1+4+1	0	0
	UDC/LDC	01	0	0
	Stenographer	01	0	0
	Ass. Technician	02	1+1	2
	Hindi translator	0	0+0	0
	Driver	1	0+1	1
	MTS	06	2+3	3
	Sub-Total	18	3+5 = 08	6
	G. Total	47	27	20

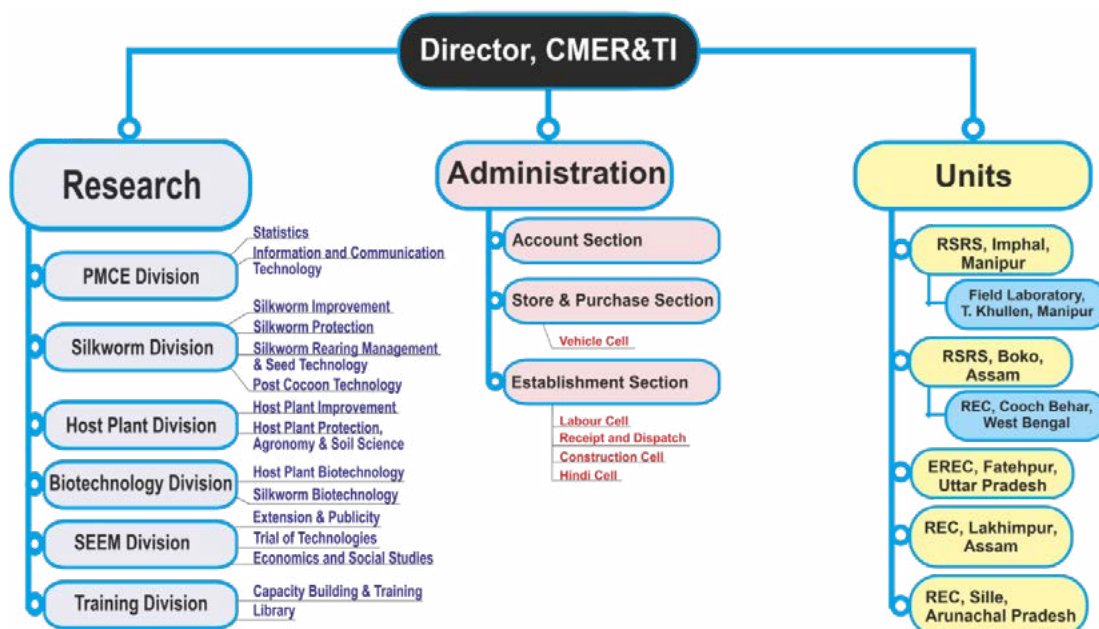




EXTENSION NETWORK



ORGANIZATIONAL SETUP





वैज्ञानिक अमला Scientific Personnel

के. रे. बो. - के.मू.ए. अ.ए.प्र.स. CSB-CMER&TI (मुख्य संस्थान Main institute)

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	Sh. Sinto Antoo, M.Sc. (Agri.) Scientist-B Specialization: Plant Physiology, Plant Biotechnology sintoantoo.csb@nic.in, sintoanto20@gmail.com

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Regional Sericulture Research Station (RSRS), Imphal, Manipur

	Dr. Y. Debaraj, M.Sc., Ph. D. Scientist –D (Retired from Board's Service on 29.02.2024) Specialization: Sericulture rtrsmp.csb@nic.in yumdebnamraj@gmail.com
	Dr. Reeta Luikham, M.Sc., Ph. D. Scientist –D (transferred to RSRS Imphal on 05.07.2023) Specialization: Zoology, Sericulture reeta_luikham@rediffmail.com
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	Dr. S. Subharani Devi, M.Sc., Ph. D. Scientist – D Specialization: Sericulture drsubharani@gmail.com
	Dr. Kh. Subadas Singh, M.Sc., Ph. D. Scientist – C Specialization: Entomology mailsubadas@gmail.com

REC, Lakhimpur, Assam

	Sh. Pulak Rabha, M.Sc. Scientist –B Specialization: Sericulture pulak307@gmail.com
--	--

REC, Coochbehar, West Bengal

Sh. Subrat Kumar Sarkar	Senior Technical Assistant Research Extension Centre, Khagrabari, Near Truck Syndicate, Coochbehar-736179, West Bengal
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REC, Fatehpur, Uttar Pradesh

	Sh. Suraj Pal, M.Sc. Scientist –D Specialization: Sericulture fatehpur.erec@gmail.com surajpal581@gmail.com
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DELEGATED AND NON-DELEGATED UNITS OF CSB-CMER&TI

Delegated Units

Central Muga Eri Research & Training Institute, Lahdoigarh, Assam (Main Institute)

Non-Delegated Units

Regional Sericulture Research Station, Boko, Kamrup, Assam (from Sept., 2021)

Regional Sericulture Research Station, Imphal, Manipur (from Sept., 2021)

Research Extension Centre, Coochbehar, West Bengal

Research Extension Centre, Lakhimpur, Assam

Research Extension Centre, Fatehpur, Uttar Pradesh





अनुसंधान सलाहकार समिति RESEARCH ADVISORY COMMITTEE

(upto 30.09.2023)

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The Commissioner & Secretary

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Sri. Binud Borah

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In-charge

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Member Convener

Director,
CSB-Central Muga Eri Research & Training
Institute, Lahdoigarh, Jorhat - 785700, (Assam)





मुख्य उपलब्धियों (2023-24)

केन्द्रीय मूगा एरी अनुसंधान एवं प्रशिक्षण संस्थान, लहदोईगढ़

केन्द्रीय मूगा एरी अनुसंधान एवं प्रशिक्षण संस्थान, लहदोईगढ़, जोरहाट स्थित अनुसंधान और विकास के लिये सम्पूर्ण संस्थान है जिसमें आरएसआरएस, बोको, आरएसआरएस, इंफाल और आरईसी शामिल हैं आरईसी मुख्यतः लखीमपुर (असम), सिले (अरुणाचल प्रदेश), कूचबिहार (पश्चिम बंगाल) और फतेहपुर (उत्तर प्रदेश) में स्थित हैं। यह संस्थान पूर्वी और उत्तर-पूर्वी क्षेत्रों में मूगा, एरी और ओक तसर उद्योगों के विकास के लिए अनुसंधान और विकास (आरएंडडी) समर्थन प्रदान करता है। वर्ष 2023-24 के दौरान किए गए अनुसंधान कार्यों का संक्षिप्त विवरण नीचे प्रस्तुत है:

I. आरएंडडी परियोजनाओं में महत्वपूर्ण उपलब्धियां:

संभावित अरंडी अभिग्रहणों का उपयोग संकरकरण कार्यक्रम में किया गया ताकि बेहतर गुणों वाली बारहमासी अरंडी की किस्म विकसित की जा सके। विभिन्न क्रॉस संयोजनों से एफ₂ पीढ़ी में 26 बारहमासी गुणों वाली किस्मों को चुना गया है। इन चयनित बारहमासी किस्मों का आवर्ती चयन जारी है ताकि मध्यवर्ती/श्रेष्ठ बारहमासी अरंडी की किस्म को विकसित किया जा सके।

एरी रेशम कीट के बारहमासी खाद्य पौधे, बोरपत के नर्सरी तकनीकों को मानकीकृत किया गया। इन तकनीकों को विस्तार से बताते हुए एक "तकनीकी बुलेटिन" भी प्रकाशित किया गया है। किसान इसे अपनाकर बोरपत नर्सरी स्थापित करने का उद्यमिता कार्य कर सकते हैं।

मशीन लर्निंग एल्गोरिदम का उपयोग करके पूर्वोत्तर भारत के ऊपरी ब्रह्मपुत्र घाटी में मिट्टी के जैविक कार्बन (SOC) का डिजिटल नक्शा बनाया गया, जिससे मिट्टी के पर्यावरणीय सहवर्ती और स्थानिक वितरण मॉडल विकसित करने में मदद मिली। ये SOC मानचित्र मिट्टी की गुणवत्ता में परिवर्तनों का आकलन करने के लिए बहुमूल्य उपकरण प्रदान करते हैं।

विभिन्न मौसमों में मूगा रेशम कीट के पालन और बीज उत्पादन का तुलनात्मक विश्लेषण किया गया, जिसमें चार खाद्य पौधों: सोम (*पर्सिया बंबिसिना*), सोलू (*लिट्सिया मोनोपेटाला*), दीघलोटी (*लिट्सिया सालिसिफोलिया*) और मेजंकरी (*लिट्सिया क्यूबा*) पर ध्यान केंद्रित किया गया। अध्ययन ने सोम और सोलू (या इसके विपरीत) के संयोजन की श्रेष्ठता को प्रदर्शित किया, जबकि दीघलोटी और मेजंकरी के संयोजन ने भी आशाजनक परिणाम दिखाए।

मूगा रेशम कीट और इसके प्रमुख खाद्य पौधे सोम (*पर्सिया बंबिसिना*) को उच्च CO₂ और तापमान के तहत ओपन टॉप चैम्बर्स (OTCs) विशेष रूप से OTC-3 (eCO₂+eTemp.) में





कीटपालन करने से लार्वा की अवधि लंबी हो गई और रेशम अनुपात और जैव रासायनिक घटकों (प्रोटीन और कार्बोहाइड्रेट) में वृद्धि हुई। हालाँकि, सोम पौधों में पत्ती क्षेत्र की क्षति और लार्वा की मृत्यु दर भी OTC-3 में अधिक दर्ज की गई, जिससे मूगा संस्कृति पर पर्यावरणीय परिवर्तनों के प्रतिकूल प्रभाव को रेखांकित किया गया।

मूगा रेशम कीट के प्रमुख खाद्य पौध सोम (*पर्सिया बंबिसिना*) का वायु प्रदूषण सहनशीलता सूचकांक (APTI) का अध्ययन किया गया। यह निष्कर्ष निकाला गया कि सोम पौधा वायु प्रदूषण के प्रति एक निश्चित स्तर की सहनशीलता प्रदर्शित करता है, और APTI स्कोर मौसमी भिन्नताओं और पर्यावरणीय तनावों से प्रभावित हो सकते हैं। यह खोज मूगा रेशम उत्पादन को बढ़ते औद्योगिकीकरण और प्रदूषण के मद्देनजर बनाए रखने के लिए संरक्षण उपायों को विकसित करने के लिए महत्वपूर्ण है।

एरी रेशम कीट पालन के लिए बारहमासी खाद्य पौधों की उपलब्धता बढ़ाने के लिए आईसीएफआरआई-आरएफआरआई के साथ एक सहयोगी परियोजना शुरू की गई है। यह कार्यक्रम संभावित एरी खाद्य पौध बोरपत (*एलेन्थस ग्रैंडिस*) के लिए क्लोनल प्रोपेगेशन तकनीक विकसित करने का लक्ष्य रखता है।

एरी रेशम कीट अंडों के सिंक्रोनाइजेशन के लिए ब्लैक बॉक्सिंग शेड्यूल को मानकीकृत किया गया है, जिसमें 95% अंडे फूटने और 1% से कम मृत्यु दर प्राप्त होती है।

बड़े पैमाने पर वाणिज्यिक एरी खुले अंडा उत्पादन तकनीक विकसित की गई, जो कई लाभ प्रदान करती है। विशेष रूप से, इससे समय बचाता है, प्रति इकाई क्षेत्र में डीएफएल उत्पादन बढ़ाता है, अंडा-प्रबंधन को सरल बनाता है, अंडा संकलन को सुव्यवस्थित करता है और अंडा धोने और कीटाणुशोधन प्रक्रियाओं को अनुकूलित करता है। इसके अलावा, यह अंडों की बढ़ती मांग को पूरा करने के लिए एरी डीएफएल उत्पादन को बढ़ाने की अपार संभावनाएं रखता है।

अनुसंधान से यह पता चला है कि *नोज़मा* निकट से संबंधित जीवों को प्रभावित कर सकता है, जो इसकी मेजबान जीव के साथ समवर्ती विकास को दर्शाता है। एरी और मूगा रेशम कीट को संक्रमित करने वाले *नोज़मा* प्रजातियों के पूर्ण जीनोम अनुक्रम को डिक्लिफ़ किया गया है। इसके अलावा, बीज उत्पादन के दौरान निमूल को अंडा उपचार के लिए NaOCl के एक व्यावहारिक विकल्प के रूप में पहचाना गया है। इसे मूगा पालन क्षेत्रों में भी पेब्राइन संक्रमण को कम करने के लिए उपयोग किया जा सकता है।

आर्टिफिशियल इंटेलिजेंस और मशीन लर्निंग मॉडल का उपयोग करके *नोज़मा स्प. Aa1* का पहचान करने के लिए एक मोबाइल ऐप विकसित किया गया है।





एरी रेशम कीट सुधार कार्यक्रम के तहत, F_2-F_6 पीढ़ियों से चयन किए गए, जिसके परिणामस्वरूप 02 उच्च प्रजनन क्षमता वाली श्रेणी (प्रजनन क्षमता 400 से अधिक) की पहचानी की गई। बाद के पीढ़ियों में आवर्ती चयन का निरंतर आवेदन एक उच्च प्रजनन क्षमता वाली नस्ल विकसित करने का वादा किया गया है, जो क्षेत्रीय बाधाओं को संबोधित करने और एरी संस्कृति के बड़े पैमाने पर वाणिज्यिक शोषण को सुविधाजनक बनाने के लिए तैयार है। जीसीए परीक्षण के आधार पर 03 संकर संयोजनों (BYP x TGBP, C2 x BYP और GYP x TGBP) का भी चयन किया गया।

अक्टूबर-नवंबर वाणिज्यिक फसल-मौसम के दौरान गुणवत्ता वाले बीज की उपलब्धता में सुधार के उद्देश्य से मूगा रेशम बीज कीट पालन को ओडिशा, आंध्र प्रदेश, अरुणाचल प्रदेश, पश्चिम बंगाल और मिजोरम के चयनित ठंडे क्षेत्रों में किया गया। प्रारंभिक संकेत बताते हैं कि मूगा को पूर्वोत्तर क्षेत्र के बाहर पाला जा सकता है और इन क्षेत्रों का बीज और पूर्व बीज पालन के लिए जून-सितंबर के दौरान उपयोग किया जा सकता है।

एन्थेरिया प्रोयली कीटों में अंडा देने को उत्तेजित करने वाले 58 रासायनिक संकेतकों की पहचान की गई और उन्हें खाद्य पौधों के पत्ते और तने के वाष्पशील तत्वों से गैस क्रोमैटोग्राफी-इलेक्ट्रोएंटेनोग्राफिक डिटेक्शन (GC-EAD) और गैस क्रोमैटोग्राफी-मास स्पेक्ट्रोस्कोपी (GC-MS) के माध्यम से पुष्टि की गई।

उच्च तापमान पर बेहतर उत्तरजीविता (%) के साथ ओक तसर रेशम कीट (*Antheraea proylei*) की एक ताप-सहिष्णु लाइन C-27-T विकसित की गई। यह लाइन उच्च तापमान के कारण फसल हानि को दूर करने का वादा रखती है।

थर्मो-सहिष्णु लाइन की पहचान के लिए SCAR मार्कर विकसित किए गए। थर्मल सहिष्णुता के पीछे के आणविक तंत्र को समझना ओक तसर रेशम कीट में अनुकूलन के आधार का अंतर्दृष्टि प्रदान करेगा।

ओक तसर रेशम कीट *एन्थेरिया प्रोयली*, *एन्थेरिया पर्नी*, *एन्थेरिया फ्रिथी* और एरी और मूगा रेशम कीटों की नौ विकसित नस्लें, तीन इको-रेस का आरएसआरएस, इंफाल में जर्मप्लाज्म बैंक में कीट पालन किया जा रहा है।

॥ तकनीकी स्थानांतरण और विस्तार गतिविधियां:

संस्थान द्वारा तीन वन्या रेशम कृषिमेले, आठ फील्ड डे, तीस जागरूकता कार्यक्रम और तीस प्रौद्योगिकी प्रदर्शन कार्यक्रम आयोजित किए गए। इन कार्यक्रमों के माध्यम से लगभग 4575 व्यक्तियों को अवगत बनाया गया।





वर्ष के दौरान दस नई विकसित प्रौद्योगिकियों का ऑन-स्टेशन परीक्षणों के माध्यम से सत्यापन किया गया और ग्यारह प्रौद्योगिकियों का विभिन्न स्थानों पर 670 लाभार्थियों को ऑन-फार्म परीक्षणों के माध्यम से परीक्षण किया गया।

वर्ष के दौरान मूगा और एरी के 9,653 उच्च खाद्य पौधों की आपूर्ति 86 लाभार्थियों को की गई। पॉलीबैग में 7,000 पौधे और नर्सरी बेड में 30,000 पौधे अगले रोपण मौसम में आपूर्ति के लिए तैयार हैं। इससे किसानों के खेतों में लगभग 22 एकड़ में उच्च खाद्य पौधों अभिग्रहणों का रोपण बढ़ाने में मदद मिली है। इसके अलावा, मिजोराम, पंजाब और 25 लाभार्थियों को 151 किग्रा एनबीआर अरंडी के बीजों की आपूर्ति बड़े पैमाने पर लोकप्रियकरण के लिए की गई।

एरी अंडा ऊष्मायन डिवाइस के मूल्यांकन और लोकप्रियकरण के लिए ओएफटी द्वारा एरी अंडा ऊष्मायन डिवाइस में नियंत्रण के मुकाबले 15-20% सुधार दिखाया।

किसानों के खेतों में एरी चौकी रेशम कीट पालन तकनीक का ओएफटी ने में पारंपरिक पालन की तुलना में कोकून उपज में महत्वपूर्ण वृद्धि (>20%) दिखाया।

ओक तसर संस्कृति में उज़ी मक्खी नियंत्रण के लिए आईपीएम तकनीक के सत्यापन द्वारा 5 से 7% उज़ी मक्खी के संक्रमण के नियंत्रण में 12 से 16% अधिक पाया गया।

ओक तसर रेशम कीट के टाइगर बैंड रोग के खिलाफ बीज उपचार के लिए सोडियम हाइपोक्लोराइट के उपयोग की तकनीक को ओएफटी के माध्यम से सत्यापित किया गया, जिसमें नियंत्रण के मुकाबले 0.2% सोडियम हाइपोक्लोराइट उपचारित बैच में 43-46% कोकून की संख्या में सुधार दर्ज किया गया।

क्वेक्स सेराटा पर कीट संक्रमण नियंत्रण के लिए जैव कीटनाशकों के उपयोग की तकनीक को 14वें दिन बायोनीम के अनुप्रयोग के बाद 70-75% कीट संक्रमण की कमी दर्ज किया गया।

पोस्ट कोकून तकनीक:

मूगा सुपर कुक फॉर्मूलेशन का कई राज्य विभाग के रीलिंग इकाइयों में ओएसटी मोड के माध्यम से परीक्षण और सत्यापन किया गया, जिससे मूगा कोकूनों की रीलिंग प्रदर्शन में सुधार करने में 12-15% तक की वृद्धि के साथ-साथ कोकून पकाने की प्रक्रिया की अवधि को कम करने में भी मदद मिली। निष्कर्ष बताते हैं कि मूगा सुपर कुक फॉर्मूलेशन मूगा रेशम रीलिंग क्षेत्र में कोकून प्रसंस्करण की दक्षता और प्रभावशीलता को बढ़ाने की क्षमता रखता है। उत्पाद को लाइसेंसिंग और व्यावसायीकरण के लिए काम किया जा रहा है।





प्रशिक्षण और क्षमता निर्माण कार्यक्रम:

कुल 1958 किसानों, अधिकारियों, छात्रों और एनजीओ सदस्यों को पांच विभिन्न प्रशिक्षण घटकों के तहत प्रशिक्षित/उन्नत किया गया जैसे कि किसान कौशल प्रशिक्षण, प्रौद्योगिकी अभिविन्यास कार्यक्रम, पोस्ट कोकून क्षेत्र के तहत प्रशिक्षण, सेरीकल्चर संसाधन केंद्र के तहत प्रशिक्षण, एसटीईपी के तहत प्रबंधन विकास कार्यक्रम और गैर-सीबीटी वित्त पोषित प्रशिक्षण। 40 लाभार्थी किसानों को एरी चौकी कीट पालन तकनीक में भी प्रशिक्षित किया गया। इसके अलावा इस संस्थान के वैज्ञानिकों द्वारा पाँच पीजीडीएस छात्रों को पर्यवेक्षक के रूप में उनका शोधकार्य पूरा करवाया गया।

प्रमाणपत्र प्राप्त पेटेंट विवरण:

14.03.2024 को एरी मूगा और शहतूत की कोकूनिंग के उपकरण के आविष्कार के लिए एक पेटेंट प्राप्त हुआ है, जिसमें पेटेंट संख्या 526129 है। यह आविष्कार आरएसआरएस बोक्को के तहत सीएमईआरटीआई लहदोईगढ़ में लागू किए गए एक डीएसटी वित्त पोषित परियोजना "एमओई 05003 ईएफ: एरी संस्कृति में सुधार प्रौद्योगिकियों और कौशल विकास को अपनाकर किसानों के सामाजिक-आर्थिक उत्थान" का परिणाम था।

एमओयू / एमओए हस्ताक्षरित और स्थिति:

अनुसंधान और विकास सहयोग को बढ़ाने के लिए, सीएसबी-सीएमईआर एंड टीआई ने प्रतिष्ठित संस्थानों के साथ समझौता ज्ञापन / समझौतों (एमओयू/एमओए) पर हस्ताक्षर किए हैं। ये समझौते रेन फॉरेस्ट रिसर्च इंस्टीट्यूट (आईसीएफआरई-आरएफआरआई), जोरहाट और कल्याण फाउंडेशन, गुजरात के साथ हस्ताक्षरित किए गए। हस्ताक्षर समारोह भारत टेक्स-2024 में हुआ, जिसका उद्देश्य नवाचार और ज्ञान विनिमय को बढ़ावा देना था।





HIGHLIGHTS OF ACHIEVEMENTS (2023-24)

Central Muga Eri Research & Training Institute, Lahdoigarh, Jorhat with a network of RSRS, Boko, RSRS, Imphal and RECs located at Lakhimpur (Assam), Sille (Arunachal Pradesh), Coochbehar (West Bengal) and Fatehpur (Uttar Pradesh) provides R&D support for the development of muga, eri and oak tasar industries especially in eastern and North-eastern regions of the country. A brief highlight of the research works done during the year 2023-24 is presented below:

Host Plant Improvement, Production and Protection

- Potential castor accessions were utilized in the hybridization programme for the development of perennial castor variety with improved characteristics. 26 perennial trait lines were selected in F₂ generation from various cross combinations. Recurrent selection of these selected perennial lines in subsequent generations is in progress for the development of intermediate/superior perennial castor cultivar/s.
- Standardized nursery raising techniques of the perennial host plant, Borpat for eri silkworm. A technical bulletin has been published detailing these techniques. Farmers can adopt this as an entrepreneurial venture to establish Borpat nurseries.
- Machine learning algorithms were employed to digitally map Soil Organic Carbon (SOC) in the Upper Brahmaputra Valley of Northeastern India, aiding in the development of environmental covariates and spatial distribution models of soils. These SOC maps offer insights into predicted uncertainties, offering valuable tools for assessing shifts in soil quality.
- A comparative analysis of Muga silkworm rearing and grainage performance across various seasons was conducted, focusing on four food plants: Som (*Persea bombycina*), Soalu (*Litsea monopetala*), Dighloti (*Litsea salicifolia*), and Mejankori (*Litsea cubeba*). The study demonstrated the superiority of the combination of Som and Soalu (or vice versa), with the subsequent combination involving Dighloti showing promising results.
- Exposing muga silkworms and its primary host plant Som (*Persea bombycina*) to elevated CO₂ and temperature within Open Top Chambers (OTCs) resulted in prolonged larval duration and increased silk ratio and biochemical constituents (protein and carbohydrate), notably observed in OTC-3 (eCO₂+eTemp.). However, higher levels of leaf area damage in Som plants and larval mortality were also recorded in OTC-3, underscoring the adverse effects of environmental changes on muga culture.
- In the first such study, the Air Pollution Tolerance Index (APTI) of the primary host plant of muga silkworm 'Som (*Persea bombycina*)' was worked out. It was concluded that Som demonstrates a degree of resilience to air pollution, with APTI scores potentially influenced by seasonal fluctuations and environmental stressors. The finding is important for assessing *P. bombycina*'s tolerance levels to develop protective





measures for sustaining Muga silk production in the face of increasing industrialization and pollution.

- To bolster the availability of perennial host plants for Eri silkworm rearing, a collaborative project with ICFRE-RFRI has commenced. This programme is aimed at developing a clonal propagation technique for the potential Eri host plant, Borpat (*Ailanthus grandis*).

Silkworm Improvement, Production and Protection

- Standardized Black boxing schedule for synchronization of eri silkworm egg hatching by using three days laid eggs with 95% hatching and less than 1% mortality.
- A pioneering Large-scale Commercial Eri Loose Egg Production technology was developed, offering a plethora of benefits. Notably, it saves time, boosts DFLs production per unit area, simplifies oviposition handling, streamlines egg harvesting, and optimizes egg washing and disinfection processes. Furthermore, this innovation holds tremendous potential for scaling up Eri DFLs production to meet increasing demand.
- Research has revealed that *Nosema* can impact closely related organisms, indicating its concurrent evolution with the host organism. The complete genome sequences of *Nosema sp.* infecting Eri and Muga silkworms have been deciphered. Additionally, Nirmool has been identified as a viable alternative to NaOCl for egg treatment in grainage. It can also be applied in muga rearing fields to mitigate pebrine incidence.
- Developed a mobile App for identification of pebrine (*Nosema sp. Aal*) detection using Artificial Intelligence and Machine learning models.
- Under the eri silkworm improvement programme, selections made from F2-F6 generations have led to the identification of 02 higher fecundity lines (Fecundity above 400 nos). The continual application of recurrent selection in subsequent generations holds the promise of developing a high fecundity breed, poised to address regional constraints and facilitate large-scale commercial exploitation of eri culture. 03 Hybrid combinations (BYP x TGBP, C2 x BYP and GYP x TGBP) were also selected based on the GCA test.
- The Muga super cook formulation underwent testing and verification through OST mode at several state department reeling units, yielding promising results in improving the reeling performance of muga cocoons. The formulation showed improvements in reelability and raw silk recovery by up to 12-15%, besides reducing the duration of the cocoon cooking treatment process. The findings suggest that the Muga super cook formulation holds the potential to enhance the efficiency and effectiveness of cocoon processing within the muga silk reeling sector.
- With an aim to improve quality seed availability during Oct-Nov commercial season Muga silkworm rearing was conducted in identified cooler regions of Odisha, Andhra





Pradesh, Arunachal Pradesh, West Bengal and Mizoram. Initial leads indicate that muga can be reared outside of the Northeast region and these areas can be exploited for seed and pre-seed rearing during June-September.

- 58 Chemical cues that are responsible for stimulating egg laying in *A. proylei* moths were identified and confirmed through gas chromatography–electroantennographic detection (GC-EAD) and Gas chromatography-mass spectroscopy (GC-MS) from host plant leaves and stem volatiles.
- Developed C-27-T, a thermo-tolerant line of Oak Tasar silkworm (*Antheraea proylei*) with better survival (%) at higher temperatures. The line holds the promise of overcoming crop loss due to high temperatures.
- Developed SCAR Markers for identification of thermo-tolerant lines. Understanding of molecular mechanism behind the thermal tolerance will give insight into the basis of adaptation in oak tasar silkworms.
- Three species of Oak tasar silkworm *A. proylei*, *A. pernyi*, and *A. frithi* and nine evolved breeds, three eco-races of eri and muga silkworm are being maintained in Germplasm bank at RSRS, Imphal.

Transfer of technology

- To enhance research and development collaboration, CSB-CMER&TI has forged Memorandums of Understanding / Agreements (MoUs/MoAs) with esteemed institutions. These agreements were inked with the Rain Forest Research Institute (ICFRE-RFRI), Jorhat, and the Kalyan Foundation, Gujarat. The signing ceremony took place amid Bharat Tex-2024, fostering partnerships aimed at advancing innovation and knowledge exchange.
- Three Vanya Resham Krishimelas, 02 workshops, 08 Field Days, 30 awareness programmes and 30 technology demonstration programmes were organized by the Institute. About 4575 persons were sensitized through these programmes during the year.
- A total of 1958 nos. of farmers, officials, students and NGO members were trained/up-skilled under five different training components Farmers Skill Training, Technology Orientation Programme, Training under Post cocoon Sector, Training under Sericulture Resource Centre, Management Development Programme under STEP, awareness programme on National Seed Act and Non-CBT funded trainings. 40 beneficiary farmers were also trained in eri chawki rearing technology. Also, 05 PGDS students completed their dissertation work under the supervision of CSB-CMER&TI Scientists.
- During the year 10 newly developed technologies were test verified through on-station trials and 11 technologies were tested through on-farm trials at different locations covering 670 beneficiaries.
- During the year 9,653 seedlings of Muga and Eri superior host plants were supplied to 86 beneficiaries. 7,000 seedlings in polybags and 30,000 seedlings in nursery beds are





ready for supply in the forthcoming plantation season. This has supported augmenting the plantation of superior host plant accessions at farmers' fields about 22 acres. Also, 151 kg NBR castor seeds were supplied to DoS, Mizoram; DoS, Punjab; and 25 beneficiaries for large-scale popularization.

- OFT for evaluation and popularization of the Eri egg incubation device has revealed a 15-20% improvement in hatching in the new Eri egg incubation device over the control.
- OFT of eri chawki rearing technology in the farmers' field has shown a significant increase in the cocoon yield in the chawki-reared batch (>20%) over the conventional rearing carried by the farmers.
- Validation of IPM technology for control of uzi fly in oak tasar culture has revealed 5 to 7 % uzi infestation with IPM as against 12 to 16 % in control.
- The technology 'Use of Sodium hypo-chlorite for seed treatment against tiger band disease of oak tasar silkworm' was validated through OFT by recording 43-46% improvement in number of cocoons harvested in 0.2 % Sodium hypochlorite treated lot over control.
- The technology 'Use of Biopesticides for control of insect pest infesting *Q. serrata*' was validated by recording a 70-75 % reduction of pest infestation on the 14th day after application of Bioneem.
- During the year Scientists of CSB-CMER&TI and its nested units published 09 research/review papers in National and International journals, 09 books/book chapters and manuals, 19 extension booklets/bulletins and 24 abstracts. The cumulative NAAS Score was 63.06 and the cumulative Impact Factor was 24.4.

Patent granted with details

- A patent has been granted for an invention of the Device for Cocooning of Eri, Muga and Mulberry on 14.03.2024 with Patent No. 526129. The invention was the outcome of a DST-funded project "MOE 05003 EF: Socio-economic uplifting of farmers through the adoption of improved technologies and skill development in eri culture" implemented at RSRS Boko, under CMERTI Lahdoigarh

MoU / MoA signed and status

- To enhance research and development collaboration, CSB-CMER&TI has forged Memorandums of Understanding / Agreements (MoUs/MoAs) with esteemed institutions. These agreements were inked with the Rain Forest Research Institute (ICFRE-RFRI), Jorhat, and the Kalyan Foundation, Gujarat. The signing ceremony took place amid Bharat Tex-2024, fostering partnerships aimed at advancing innovation and knowledge exchange.





परियोजनाओं की सूची LIST OF R&D PROJECTS

सम्पन्न परियोजनाएं PROJECTS CONCLUDED IN 2023-24:

Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
1	AIB - 05009 SI	Isolation of thermo-tolerant line(s) of oak tasar silkworm <i>Antheraea proylei</i> J (CSB-funded project)	Oct.,2019 to Sept.,2022 (Extended up to Sept., 2023)	Y. Debaraj	S. Subharani Devi, Arun Kumar KP
2	AIB-05012-SI	Inter and intra-specific hybridization for improvement of eri silkworm, <i>Samia ricini</i> Donovan. (CSB funded project)	Mar., 2020 to Feb., 2024	Reeta Luikham (up to 05.07.2023) Aftab A. Shabnam (from 06.07.2023)	Aftab A. Shabnam (upto 05.07.2023) Mahesh D S (from 06.07.2023)
3	ARP-05015-SI	Development of chemical-based control measures for the management of pebrine disease in Muga silkworm, <i>Antheraea assamensis</i> Helfer	Jan.,2021 to Dec.,2023	Arun Kumar KP	-
4	APR-05018-MI	Effect of various host plants separately and in combination on Rearing and grainage performance of Muga silkworm, <i>Antheraea assamensis</i> Helfer (Collaboration with MESSO, Guwahati)	Mar.,2021 to Feb.,2024	D. K. Jigyasu (w.e.f. 01.07.2022), Kh. Subadas Singh (upto 30.06.2022)	S.A.S. Rahman, Vikram Kumar
5	APS-05020-MI	Commercial egg production technology for eri-culture (Collaboration with EBSF, MESSO, Topatoli)	Feb., 2022 to Jan., 2024	Mahesh D.S.	Arun Kumar K.P., Lalita Natrajan
6	MOE-05022-MI	Evaluation and popularization of improved technologies developed in the field of Muga, Eri & Oak sector for Northeastern India (On-farm/on-station trials of CMERTI-Lahdoigarh)	Feb., 2022 to March, 2024	D. K. Jigyasu	Suraj Pal, James T Keisa, Yumnam Debaraj. L. Somen Singh, B.N. Choudhury, SAS Rahman, Diganta Mech, Aftab A. Shabnam,



Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
		(collaboration with all nested units of CSB-CMER&TI and MESSO)			Subharani Devi, Arun Kumar KP, Amit Kumar, Subadas Singh, Vijay. N, Mahesh D S, Manjunath R N, Abhishek Singh

नैरंतरिक परियोजनाएं ON GOING RESEARCH PROJECTS:

Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
1	AIP-05013-SI	Impact of elevated CO ₂ and temperature on muga silkworm and its primary host plant (CSB-funded project)	Mar.,2020 To Feb.,2023 (Extended upto Feb. 2025)	D.K. Jigyasu Amit Kumar (up to 30-06-2022)	Aftab A. Shabnam,
2	APS-05021-EF	Studies on population diversity and the role of host plant volatile cues for enhancing egg laying in temperate tasar silk moth (<i>Antheraea proylei</i>) (DBT-funded project): Collaboration between RSRS, Imphal; CSB-CMER&TI, Lahdoigarh; Manipur University and IIHR, Bengaluru)	Jan., 2022 to Dec., 2024	Sinam Subharani Devi	K. M. Vijayakumari
3	ARP-05023-CN	Muga and Eri silkworm disease monitoring in north eastern states of India.	Mar.2023 to Feb. 2028	Bitupon Das	Lopamudra Guha (Co-PI) and all Scientists of CSB-CMER&TI & MESSO units (CIs).
4	AIT-05024-EF (DBT funded)	Advanced-level Institutional Biotech Hubs at Central Muga Eri Research and Training Institute, Jorhat, Assam (Phase-II)	Mar. 2023 to Feb. 2026	Arun Kumar KP	Bitupan Das, Reeta Luikham, Mahesh D S
5	PIB 5025 SIC	Characterization and evaluation of Soalu (<i>Litsea monopetala</i>) accessions for	Feb.2024 to Jan 2027	Om Prakash Patidar	D.K. Jigyasu Aftab A. Shabnam





Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
		muga silkworm (<i>Antheraea assamensis</i>) rearing			
6	SPR 5026 SIC	Development of suitable Muga and Eri-based Integrated Farming System (IFS) for North East India	Feb 2024 to July 2026	Diganta Mech	Vijay N
7	MOE 5027 SIC	Economic analysis of Tapioca-based Eri-culture in Assam & Nagaland	Feb 2024 to July 2025	Vijay N	Diganta Mech
8	SPR 5028 SIC	Popularization of Improved Technologies of Muga Culture for Enhancing Cocoon Production in Manipur	Feb. 2024 to Jan 2027	Kh. Subadas Singh	L Somen Singh Vijay N
9	PIT 5029 SIC	Development of clonal propagation methods in Borpat (<i>Ailanthus grandis</i> L.) for its mass multiplication	March 2024 to Feb 2027	Om Prakash Patidar	D.K. Jigyasu
10	MOE 5030 SNC	Evaluation, optimization & Popularization of Eri-culture Practices in Castor Growing Areas of Gujarat	March 2024 to Feb 2027	Mahesh D S	K Chandrakumara, Vijay N Suraj Pal
COLLABORATIVE PROJECTS AS CoPI/CI with other Institutes:					
11	AIB 08008 MI	Development and evaluation of Eri silkworm (<i>Samia ricini</i> Donovan) breeds/ hybrids with improved productivity (SBRL)	Mar 2022 to Feb 2025	Reeta Luikham, PI	Aftab A. Shabnam (CI)
12	SRP08012 MNC	Development of a Rapid Antigen Test Kit for Diagnosis of Cytoplasmic Polyhedrosis in Vanya Silkworm (<i>Antheraea assamensis</i> , <i>A. mylitta</i> and <i>A. proylei</i>)	Feb.,2024 to Jan 2026	Bruda BN, CI	-





अनुसंधान एवं विकास परियोजनाओं की उपलब्धियाँ
ACHIEVEMENTS IN R & D PROJECTS

रेशमकीट विभाग
SILKWORM DIVISION





CONCLUDED PROJECTS

Project Code & Title : AIB-05012-SI & “Inter and intra-specific hybridization for improvement of Eri silkworm, *Samia ricini* Donovan”.

Project Period : 04 years (March, 2020 to February, 2024)

Funding Agency : Central Silk Board

Total Budget allocation : Rs. 23.15 Lakhs

Total expenditure (during the year): Rs.16.14lakhs

Scientists involved : Dr. Reeta Luikham, Sc-D (PI till June, 2023)
Dr. Aftab Ahmad Shabnam, Sc-D (CI till June, PI from July, 2023) Dr. Mahesh D S, Sc-C (CI from July, 2023)

Objectives : To develop improved cross breeds/hybrids of Eri silkworm with higher fecundity and silk yield for commercial exploitation.

SUMMARY OF THE FINDINGS/ACHIEVEMENTS:

- ❖ 03 Hybrid combinations (BYP x TGBP; C2 x BYP and GYP x TGBP) with significant improvement in cocoon traits were selected based on GCA test. Small scale trial of these hybrid combinations was completed at GCC, Chenijan. Statistical analysis of the data is in progress when this report is compiled. However, average values indicate superiority of C2 x BYP with regard to cocoon weight and shell weight.
- ❖ Selections in the F₂ generation with recurrent selection upto F₆ generation has led to the identification of 02 higher fecundity lines (Above 400 fecundity). Out of 08 lines selected initially few lines were discarded due to Pebrine outbreak.
- ❖ The continual application of recurrent selection in subsequent generations holds the promise of developing a high fecundity breed, poised to address regional constraints and facilitate large-scale commercial exploitation of ericulture.
- ❖ Borduar Yellow Plain (BYP) is found to be the best general combiner exhibiting significant GCA effect for 6 traits i.e., fecundity, larval weight, ERR%, cocoon weight, shell weight, shell ratio.
- ❖ 10x10 cross combinations in Diallel fashion, GCA and SCA analysis, Selection of Cross Combinations Based on GCA for Breed Development, Selection of Hybrid combination based on SCA, Selection of fecundity lines and their rearing performance in Generation F₁-F₆ is reflected in tables 1-18.

Table 1: Intra specific hybridization in 10X10 Diallel fashion (Griffing 1956)

Pare nts	C2 Breed	BYP	TG BP	BG BP	TG BS	GYP	TYS	BGB Z	KY P	BY Z
C2 Breed	C2 X C2	C2 X BYP	C2 X TGB P	C2 X BGB P	C2 X TGB S	C2 X GYP	C2 X TYS	C2 X BGB Z	C2 X KYP	C2 X BYZ



BYP	BYP X C2	BYP X BYP	BYP X TGB P	BYP X BGB P	BYP X TGB S	BYP X GYP	BYP X TYS	BYP X BGB Z	BYP X KYP	BYP X BYZ
TGB P	TGB P X C2	TGB P X BYP	TGB P X TGB P	TGB P X BGB P	TGB P XT GBS	TGB PX GYP	TGB P X TYS	TGB P X BGB Z	TGB P X KYP	TGB P X BYZ
BGB P	BG BP X C2	BG BP X BYP	BGB P X TGB P	BGB P X BGB P	BG BP XT GBS	BGB P X GYP	BG BP X TYS	BGB P X BGB Z	BG BP X KYP	BG BP X BYZ
TGB S	TGB S X C2	TGB S X BYP	TGB S X TGB P	TGB S X BGB P	TGB S XT GBS	TGB S X GYP	TGB S X TYS	TGB S X BGB Z	TGB S X KYP	TGB S X BYZ
GYP	GYP X C2	GYP X BYP	GYP X TGB P	GYP X BGB P	GYP X TGB S	GYP X GYP	GYP X TYS	GYP X BGB Z	GYP X KYP	GYP X BYZ
TYS	TYS X C2	TYS X BYP	TYS X TGB P	TYS X BGB P	TYS X T GBS	TYS X GYP	TYS X TYS	TYS X BGB Z	TYS X KYP	TYS X BYZ
BGB Z	BG BZ X C2	BG BZ X BYP	BGB Z X TGB P	BGB Z X BGB P	BG BZ XT GBS	BGB Z X GYP	BG BZ X TYS	BGB Z X BGB Z	BG BZ X KYP	BG BZ X BYZ
KYP	K YP X C2	KYP X BYP	KYP X TGB P	KYP X BGB P	KYP X T GBS	KYP X GYP	KYP X TYS	KYP X BGB Z	KYP X K YP	KYP X BYZ
BYZ	B YZ X C2	BYZ X BYP	BYZ X TGB P	BYZ X BGB P	BYZ X T GBS	BYZ X GYP	BYZ X TYS	BYZ X BGB Z	BYZ X KYP	BYZ X BYZ

***BYP** (Borduar Yellow Plane); **TGBP** (Titabar Greenish Blue Plane); **BGBP** (Borduar Greenish Blue Plane); **TGBS** (Titabar Greenish Blue Plane); **GYP** (Genung Yellow Plane); **TYS** (Titabar Yellow Spotted); **BGBZ** (Borduar Greenish Blue Zebra); **KYP** (Kokrajhar Yellow Plane) and **BYZ** (Borduar Yellow Zebra).

**Table 2: Analysis of variance for combining ability in a 10x 10 diallel**

Source	df	Fecundity (Nos.)	Larval wt. (g)	Cocoon wt. (g)	Shell wt. (g)	Shell ratio (%)
GCA	9	99,466.04*	0.88	0.872	0.136*	62.269*
SCA	45	208294.03**	2.813	1.517**	0.282**	136.88**
Reciprocal	45	183581.91**	3.501	1.247	0.214	111.22**
Error	198	48,014.64	7.608	1.242	0.071	98.15
GCA/ SCA ratio		0.477527	0.312	0.574	0.482	0.454

*= significant at 5%, **= significant at 1%

Table 3: GCA effects in pureline strains of Eri silkworm Eco-races.

Parents	Fecundity (Nos.)	Larval wt. (g)	Cocoon wt. (g)	Shell wt. (g)	Shell ratio (%)
BYP	28.65**	0.03	0.08**	0.035**	0.68**
TGBP	6.89**	0.02	1.39**	0.001	1.11**
C2 breed	7.99**	0.04	0.03**	0.008**	0.091
BGBP	6.71**	0.01	0.09	0.007**	0.11
TGBS	2.82	0.02	-0.02	0.006**	0.27**
BYZ	-13.47	-0.04	-0.04	-0.02	-0.44
BGBZ	-8.20	-0.01	-0.03	-0.007	-0.09
TYS	-6.87	0.03	-0.02	-0.002	-0.05
KYP	-20.45	-0.09	-0.05	-0.021	-0.44
GYP	1.93	0.01	0.02	-0.006	-0.23

*= significant at 5%, **= significant at 1%

Table 4: SCA effects of selected crosses in 10X10 diallel

Crosses	Fecundity (Nos.)	Larval wt. (g)	Cocoon wt. (g)	Shell wt. (g)	Shell ratio (%)
C2 breed x BYP	7.91**	2.72**	4.34**	9.43**	5.21**
BYP x TGBP	7.58**	1.25	3.10**	8.14**	6.85**
BYP x TGBS	7.32**	-0.31	3.00**	2.14**	1.72
BGBP x TGBS	1.98	1.75	2.45*	2.82**	4.37**
BYZ x BGBZ	1.16	0.65	1.69	6.57**	3.70**
BYP x BGBZ	5.48**	0.08	2.69**	3.00	2.08
GYP x TGBP	1.65	1.33	1.15	3.16	1.45
GYP x BGBP	1.49	1.01	1.34	4.86**	3.15**
TGBP x BGBZ	3.35**	-0.57	1.97	4.00*	2.37*
BGBZ x TYS	3.51**	0.88	2.24*	1.57	0.23
C2 x TGBP	0.56	0.82	3.55*	2.29*	2.32*
C2 x TGBS	1.00	1.04	2.93*	2.43*	0.43*



GYP x TYS	2.80**	-0.64	0.93	1.14	0.43
BGBP x BYZ	2.88**	-0.79	2.24*	0.86	-0.35
TYS x TGBS	1.61	-0.60	1.55	1.86	0.73
TGBP x BGBP	0.89	0.24	-0.97	0.14	0.72

*= significant at 5%, **= significant at 1%

Table 5: Reciprocal effects of selected crosses in 10X10 diallel

Crosses	Fecundity (Nos.)	Larval wt. (g)	Cocoon wt. (g)	Shell wt. (g)	Shell ratio (%)
GYP x TGBP	2.65**	1.33	4.34**	6.86**	3.45**
BGBZ x BYP	6.85**	0.88	-0.45	1.43	1.89
KYP x BYP	0.59	3.08**	2.35*	1.57	2.43*
KYP x TYS	1.79	-0.72	1.62	3.57**	2.20*
TGBS x GYP	6.92**	-1.14	0.17	2.41	5.25**
TGBS x BGBP	0.09	-1.32	-2.76	1.71	1.88

*= significant at 5%, **= significant at 1%

Table 6: Selection of Cross Combinations Based on GCA for Breed Development

Cross (No.)	Combination	GCA effect in both parents	
CR1	C2 breed x BYP	+	+
CR2	BYP x TGBP	+	+
CR3	BYP x TGBS	+	+
CR4	BGBP x TGBS	+	+
CR5	C2 breed x TGBP	+	+
CR6	C2 breed x TGBS	+	+
CR7	TGBP x BGBP	+	+

Table 7: Selection of Hybrid Combination Based on SCA

Hybrid no.	Hybrid	SCA effect	Traits
HY-1	C2 breed x BYP	+	05
HY-2	BYP x TGBP	+	04
HY-3	GYP x TGBP	+	04



Table 8: Grainage activities, rearing and cocoon assessment in F₁ generation

Season: March-April, 2023

Strains	Fecundity (Nos.) (Mean)	Hatching %	Larval weight (Mean)	ERR%	Cocoon weight (Mean)	Shell weight (Mean)	Shell ratio% (Mean)
CR1	376±9.46	84.95	7.15±0.06	82.65	3.60±0.07	0.50±0.01	13.76±0.21
CR2	379±11.42	88.62	7.43±0.08	82.08	3.64±0.07	0.51±0.01	13.95±0.26
CR3	370±6.89	80.84	6.84±0.09	79.68	3.47±0.07	0.48±0.01	13.80±0.22
CR4	348±7.11	81.47	6.90±0.08	82.82	3.50±0.08	0.48±0.01	13.72±0.24
CR5	375±6.79	87.86	7.19±0.07	78.78	3.59±0.06	0.50±0.01	13.88±0.24
CR6	343±5.19	89.55	7.14±0.07	77.56	3.42±0.07	0.48±0.01	13.62±0.20
CR7	371±6.70	87.95	7.06±0.07	76.74	3.49±0.07	0.49±0.01	13.18±0.22
C2 breed (control)	374±8.26	90.12	7.35±0.07	84.72	3.58±0.07	0.49±0.01	13.83±0.22
CD at 5%	NS	-	NS	-	NS	NS	NS

Table 9: Fecundity lines selected in F₂ generation

Crosses	Fecundity range (Nos.) & Mean	Fecundity Line (FL) Selection in F ₂
CR1	226-452 (333)	452 (1) & 435 (2)
CR2	235-476 (344)	454 (3), 476 (4) & 436 (5)
CR3	211-415 (338)	415 (6)
CR4	216-402 (324)	x
CR5	206-455 (338)	455 (7)
CR6	225-400 (334)	x
CR7	216-439 (332)	439 (8)
C2 breed (control)	172-382 (344)	x

Table 10: Grainage activities, rearing and cocoon assessment of selected fecundity lines in F₂ generation

Season: May-June, 2023

Lines	Fecundity (Nos.)	Hatching %	Larval weight (Mean)	ERR% (Mean)	Cocoon weight (Mean)	Shell weight (Mean)	Shell ratio% (Mean)
CR1FL1	452	97.79	7.98±0.11	49.49	2.96±0.11	0.43±0.01	14.78±0.28
CR1FL2	435	94.48	8.02±0.12	40.28	3.43±0.12	0.50±0.01	14.72±0.43
CR2FL3	454	86.56	8.11±0.11	89.63	3.46±0.08	0.48±0.01	13.89±0.27
CR2FL4	476	85.68	7.34±0.04	57.67	3.62±0.09	0.50±0.01	13.95±0.27
CR2FL5	436	91.97	7.39±0.10	59.63	3.51±0.09	0.49±0.01	13.97±0.13
CR3FL6	415	88.79	7.25±0.08	78.63	3.47±0.09	0.49±0.01	14.16±0.28
CR5FL7	455	93.10	8.41±0.09	46.92	3.58±0.10	0.47±0.01	13.47±0.37
CR7FL8	439	85.38	8.39±0.11	47.75	3.03±0.11	0.44±0.01	14.94±0.41
C2 breed (Control)	344	86.11	8.38±0.11	63.55	3.44±0.08	0.48±0.01	13.27±0.14



CD at 5%	-	-	NS	-	NS	NS	NS
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Table 11: Recurrent selection: 02 Fecundity lines in F₃ generation

Line	Fecundity range (Nos.)	Recurrent Selection in F ₃
CR2FL3	296-478 (346)	478, 445
CR3FL6	175-468 (335)	468
C2 breed (Control)	325-396 (342)	-

Table 12: Grainage activities, Rearing and Cocoon assessment of selected fecundity line in F₃ generation

Season: July-August, 2023

Fecundity lines	Fecundity (in Nos.)	Hatching %	Larval weight (Mean)	ERR%	Cocoon wt (Mean)	Shell weight (Mean)	Shell ratio% (Mean)
CR2FL3	478	86.96	6.99 ± 0.25	82.35	3.16±0.12	0.44 ±0.01	14.31±0.37
CR2FL3	445	79.28	7.54± 0.17	49.37	3.40±0.06	0.45 ±0.01	13.41±0.24
CR3FL6	468	77.13	7.09± 0.16	62.01	3.40±0.09	0.48 ±0.01	14.22±0.31
C2 (Control)	342	75	7.41± 0.06	52.40	3.25±0.07	0.44 ±0.01	13.27±0.35
CD at 5%	-	-	NS	-	NS	NS	0.98

Table 13: Recurrent selection: 02 Fecundity lines in F₄ generation

Line	Fecundity range (Nos.)	Recurrent Selection in F ₄
CR2FL3	126-520	430, 475, 421, 520, 473
CR3FL6	136-483	483, 426
C2 breed (Control)	286-375	-

Table 14: Grainage activities, Rearing and Cocoon assessment of selected fecundity line in F₄ generation

Season: Sept-Oct, 2023

Fecundity lines	Fecundity (in Nos.)	Hatching %	ERR%	Cocoon wt (Mean)	Shell weight (Mean)	Shell ratio% (Mean)
CR2FL3	430	81.63	82.17	2.39±0.04	0.39±0.01	16.44±0.12
CR2FL3	475	83.16	65.54	2.57±0.04	0.41±0.01	16.08±0.11
CR2FL3	421	82.66	60.67	2.63±0.05	0.41±0.01	15.84±0.16
CR2FL3	520	85.77	64.86	2.96±0.05	0.45±0.01	15.42±0.15



CR2FL3	473	85.62	70.90	2.83±0.05	0.45±0.01	16.09±0.14
CR3FL6	483	88.41	72.66	2.67±0.04	0.45±0.01	17.04±0.20
CR3FL6	426	85.92	67.03	2.67±0.04	0.44±0.01	16.80±0.20
C2 (Control)	375	85.33	59.62	2.80±0.05	0.42±0.005	15.25±0.21
CD at 5%	-	-	-	0.25	0.032	0.87

Table 15: Recurrent selection: 02 Fecundity lines in F₅ generation

Line	Fecundity range (Nos.)	Recurrent Selection in F ₅
CR2FL3	106-468 (323)	429,468,432, 402,451, 409,432,426,451
CR3FL6	181-480(351)	480,426,481,461
C2 breed (Control)	185-389 (307)	-

Table 16: Grainage activities, Rearing(composite) and Cocoon assessment of selected fecundity line in F₅ generation
Season: Nov-Dec, 2023

Fecundity lines	Fecundity (in Nos.) (Mean)	Hatching %	ERR%	Cocoon wt (Mean)	Shell weight (Mean)	Shell ratio% (Mean)
CR2FL3	433±8.79	70.02	47.15	3.62±0.12	0.48±0.01	13.24±0.24
CR3FL6	462±11.13	58.3	44.25	3.44±0.10	0.45±0.01	13.03±0.18
C2 (Control)	389	74.03	55.90	3.58±0.13	0.46±0.01	13.04±0.25
CD at 5%	-	-	-	NS	NS	NS

Table 17: Recurrent selection: 02 Fecundity lines in F₆ generation

Line	Fecundity range (Nos.)	Recurrent Selection in F ₆
CR2FL3	112-471 (322)	413, 471, 425, 428, 404, 448, 411
CR3FL6	102-459(248)	416,451,459
C2 breed (Control)	136-391 (289)	-

Table 18: Crosswise fecundity line selection in different generations.

Cross no.	Combination	Selection of fecundity line in F ₂	Recurrent Selection in F ₃	Recurrent Selection in F ₄	Recurrent Selection in F ₅	Recurrent Selection in F ₆
CR2	BYP x TGBP	03 (436-476)	02 (445-478)	05 (421-520)	09 (402-468)	07 (404-471)
CR3	BYP x TGBS	01 (415)	01 (468)	02 (426-483)	04 (426-481)	03 (416-459)



Project Code : ARP 5015 SI
Project Title : Development of chemical-based control measures for the management of Pebrine disease in *Anthraea assamensis* Helfer
Project Period : January, 2021 to December, 2023
Funding Agency : Central Silk Board, Bengaluru
Budget Allocation : Rs. 19.92 Lakhs
Scientists Involved : Dr. Arun Kumar KP

Objectives : 1. Effect of different chemical disinfectants and antifungal substances on survivability and infectivity of microsporidian spores
 2. Efficacy analysis and field application of chemical disinfectants suitable for the management of pebrine disease

Summary of the achievements:

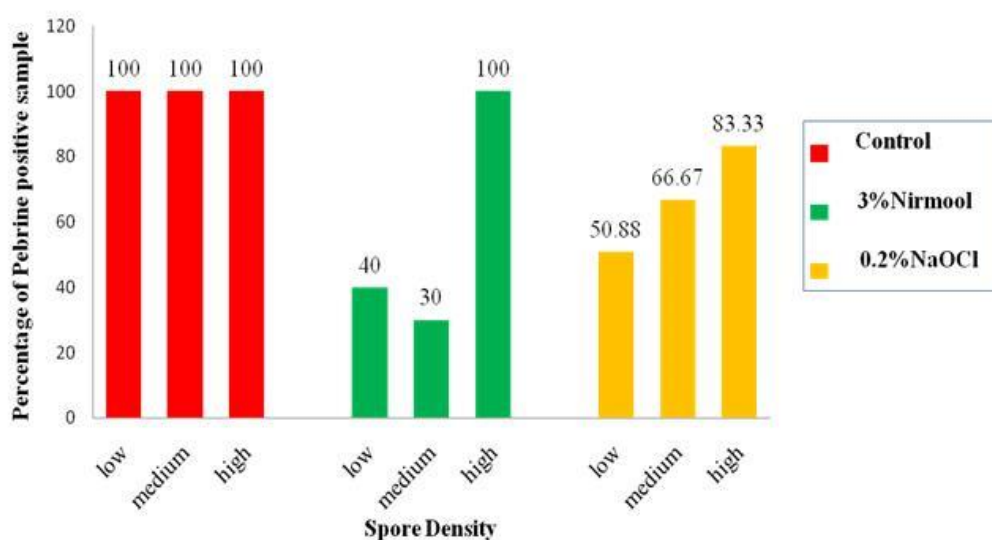
This project aims to develop therapeutic measures and generate technology for integrated management of pebrine disease in muga culture on the basis of information generated on the etiology and pathogenesis of microsporidian pathogen in muga silkworm. Egg washing studies with different chemicals to avoid transovum infection.

- Nosema spores like many species of microsporidian, in addition to being horizontally transmitted, are vertically transmitted to the offspring of infected female hosts within or on the surface of the eggs.
- Pebrine-diseased eggs were collected and washed with 0.2% NaOCl and 3% Nirmool for 5 minutes and then washed under running tap water. Control was left without treatment.
- The hatching percentage was found to be highest in 0.2% NaOCl treated low-density spore load which is 45.6% followed by 0.2% NaOCl treated medium spore density 43.5%. Least hatching was observed in control with high-density spore load. The hatching percentage in 3% Nirmool-treated eggs decreased as the eggshell was washed off due to high-concentration treatment.
- A total of 201 cocoons were obtained of which 136 adult moths emerged. The maximum number of cocoons were obtained in NaOCl treated batch *i.e.*, 117 cocoons with the highest number in 0.2% NaOCl treated low spore density of 60 numbers. Emergence was also highest in 0.2% NaOCl treated low spore density of which 57 adult moths emerged. The lowest cocoon number and emergence were observed in Control. 3% Nirmool treatment was not successful in this experiment as the data obtained was not feasible.
- Pebrine test was done on the emerged adult moths, 49% decrease observed in the 0.2% NaOCl treated low batch followed by a 33.33% decrease in pebrine infection in the 0.2% NaOCl treated medium spore density batch. Control 100% pebrine positivity was found. 3% Nirmool treatment was not successful in this experiment as the data obtained was not feasible.





- As the treatment with 3% Nirmool was not effective, the concentration of the treatment was decreased to 2%. 10 g egg layings with high-density spore (NrH) and 6g egg layings with low-density spore (NrL) were used for treatment. The hatching percentage was found to be 43% for NrH and 42% for NrL. It was found that 3% Nirmool completely washed off the eggshell exposing the inner membrane and making the embryo partially visible hence affecting the hatching percentage as well as rearing of the hatched larvae, whereas better results were obtained in treatment with 2% Nirmool.



Pebrine test in different treatments of egg washing

Project Code : APS 5020 MI
Project Title : Commercial egg production technology for ericulture
Project Period : February, 2022 to January, 2024
Funding Agency : Central Silk Board, Bengaluru
Budget Allocation : Rs. 14.65 Lakhs
Scientists Involved : Dr. Mahesh D. S, PI
 Dr. Lalitha Natarajan, Scientist D, EBSF, Topatoli, Co-PI
 Dr. Arun Kumar KP, CI

Objectives : 1. Standardization and selection of suitable egg-laying devices for commercial loose egg production in eri.
 2. Synchronization of hatching and subsequent rearing
 3. Popularization of loose egg production in Ericulture

Summary of the findings/achievements:

- Standardized the suitable egg-laying device for commercial loose egg production, which is less time-consuming, easy for oviposition handling, egg harvesting, washing, disinfection, etc. with no significant difference in realized fecundity between the new method and traditional practices.
- Standardized all the grainage techniques for the shortlisted egg-laying device and mother-moth examination techniques (mass mother examination).





- Standardized the early emerged moths' preservation and their re-use.
- Uniformity in hatching is achieved up to 95% by using the black boxing technique, synchronization of subsequent rearing performance, and reduced spinning duration.
- At EBSF, large-scale commercial loose egg production has been tested using the selected egg-laying device and proved that there is no significant difference in realized fecundity between the new method and existing practice.
- The economics of eri loose egg sheet-based grainage and kharika-based grainage have been calculated.

Table 1: No significant difference in realized fecundity between Horizontal and Vertical devices (Data from 100 moths /replication)

Treatment	Trial 1 (g)				Trial 2 (g)			
	Day 1	Day 2	Day 3	NC	Day 1	Day 2	Day 3	NC
T1-H-WW	32.89	21.26	11.89	65.26	31.67	19.66	10.58	62.11
T2-H-WoW	31.46	20.24	11.50	64.31	29.92	20.04	11.80	61.36
T3-H-PVC	31.09	21.34	11.26	64.57	29.66	19.98	10.56	60.90
T4-H-IB	32.23	21.00	10.74	64.29	29.42	20.31	10.26	60.59
T5-V-NN	30.05	22.33	11.53	64.15	28.38	20.13	11.40	59.83
T6- V-HC	31.27	19.98	11.92	64.01	28.67	21.44	10.84	60.17
T-7-Kharika	33.15	20.15	11.45	65.14	31.35	20.63	10.03	60.88
SE	0.89	0.90	0.77	1.43	0.66	0.91	0.73	0.66
P value	0.23	0.54	0.94	0.99	0.59	0.86	0.62	0.62

Table 2: Time taken for placing moths (seconds) on Horizontal and Vertical devices (Data from 100 moths /replication)

Treatment	Trial 1 (Seconds)					Trial 2 (Seconds)				
	Day 1	Day 2	Day 3	Day 4	NC	Day 1	Day 2	Day 3	Day 4	NC
T1-H-WW	119.75	119.00	131.50	106.00	156.92	124.50	111.50	136.75	90.50	142.75
T2-H-WoW	231.00	130.75	151.00	112.25	227.75	227.75	125.25	154.75	112.25	234.50
T3-H-PVC	224.30	200.25	209.35	194.00	182.00	225.00	203.50	199.25	139.75	181.50
T4-H-IB	278.32	254.75	268.82	260.45	249.50	282.25	252.75	248.00	154.50	236.25
T5-V-NN	242.82	229.25	225.57	225.45	269.75	243.75	226.50	213.00	178.25	262.75
T6- V-HC	276.75	275.75	281.50	241.50	285.25	282.00	275.75	275.00	183.75	273.00
T-7-Kharika	329.50	322.50	320.25	289.00	310.00	336.50	338.75	319.50	211.50	313.00
SE	8.76	9.51	8.44	12.65	7.28	6.62	5.38	6.56	7.40	5.53
P value	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*

**Table 3: Realized fecundity (g) in Sheet vs Kharika (With wing)**

Trials	Treatment		T Stat	P value
	Kharika	Sheet based		
Trial 1 (CMER&TI)	84.16	85.42	-0.54	0.30
Trial 2 (EBSF)	85.73	86.75	-0.33	0.37
Trial 3 (EBSF)	95.47	95.69	-0.07	0.47
Trial 4 (EBSF)	91.04	91.37	-0.17	0.43
Trial 5 (CMER&TI)	84.61	85.2	-0.27	0.39
Trial 6 (EBSF)	101.13	101.72	-0.34	0.37

*Data from 150 moths/replication***Table 4: Realized fecundity (g) in Sheet vs Kharika (With wing)**

Trial	Treatment		T Stat	P value
	KH (150) mean	WW (150) mean		
Trial 1 (CMER&TI)	393.92	253.32	6.17	<0.000001*
Trial 2 (EBSF)	394.38	237.72	6.35	
Trial 3 (EBSF)	423.18	248.08	10.62	
Trial 4 (EBSF)	405.56	235.90	11.41	
Trial 5 (CMER&TI)	400.70	231.62	6.04	
Trial 6 (EBSF)	377.44	241.08	7.40	

Data from 150 moths/replication**Figure 1: Black Boxing Schedules for Synchronization of Hatching in Ericulture**

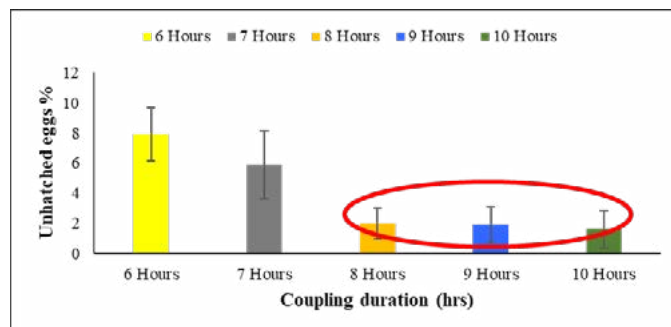
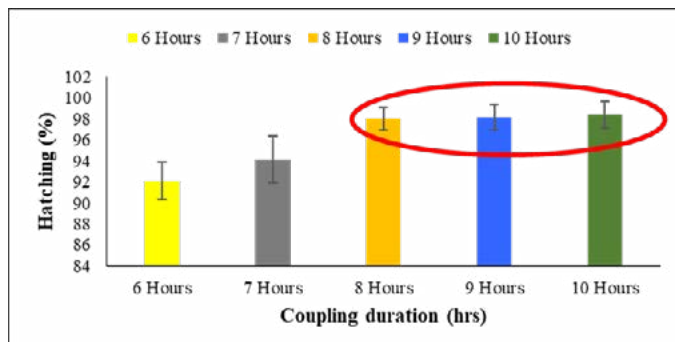
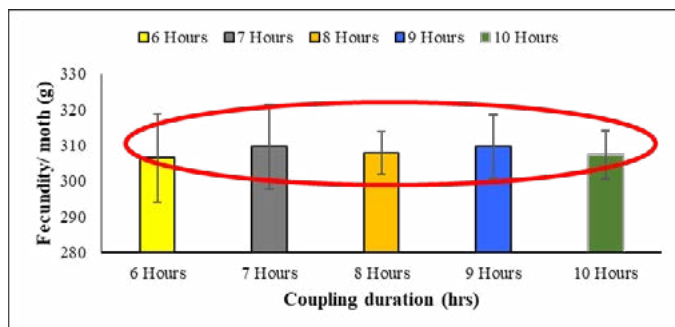


Figure 2: Optimal hatching percentage is achieved with coupling durations ranging from 8 to 10 hours

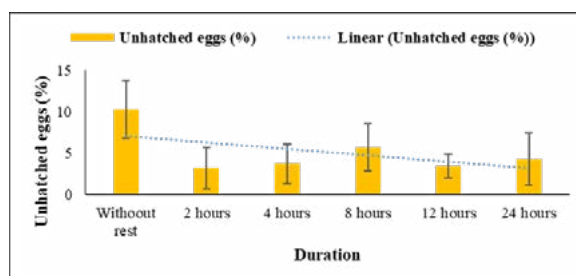
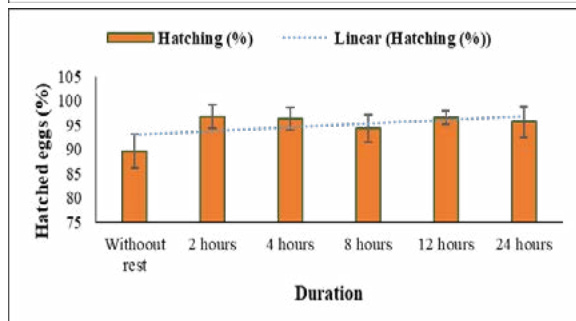
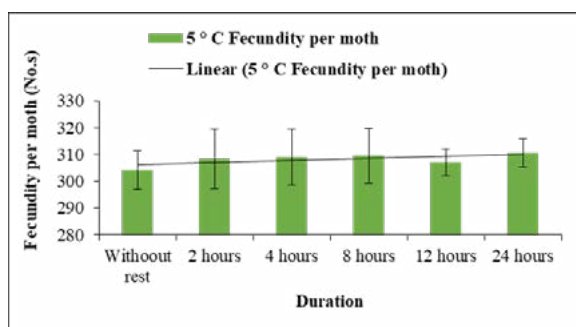


Figure 3: Minimum 2 hours rest should be given at 5 °C for re-use of male moths



Figure 3: Starched sheet-based loose egg production

Newly Sanctioned projects

Project Code : MOE 5030 SNC
Project Title : **Evaluation, Optimization and Popularization of Ericulture Practices in Castor Growing Areas of Gujarat**

Project Period : March, 2024 to February, 2026
Funding Agency : Central Silk Board, Bengaluru
Budget Allocation : Rs. 45.90 Lakhs
Scientists Involved : Dr. Mahesh, Scientist-C, PI (CSB-CMER&TI)
 Dr. K Chandrakumara, Scientist-B-CI (CSB-CMER&TI)
 Mr. Suraj Pal, Scientist-D-CI (REC, Fatehpur)
 Dr. Vijay N, Scientist-C-CI (CSB-CMER&TI)
 Kalyan Foundation, Palanpur, Gujarat
 Mr. Satish Singh, Executive member-PI
 Mr. Nitin Jaimini, Member-CI

Objectives :

1. To evaluate and optimize the Ericulture practices in castor-growing regions of Gujarat state through the available technologies and practices.
2. To propagate and promote Ericulture in castor-growing areas of Gujarat state to augment farmers' income by raising awareness and encouraging the adoption of efficient and sustainable practices.

Summary of the findings/achievements: The project was recently coded (March 2024).





खाद्य पौध विभाग

HOST PLANT DIVISION





CONCLUDED PROJECTS

Project Code	: APR 5018 MI
Project Title	: Effect of various host plants separately and in combination on rearing and grainage performance of muga silkworm, <i>Antheraea assamensis</i> Helfer
Project Period	: March 2021 to February 2024
Funding Agency	: Central Silk Board, Bengaluru
Budget Allocation	: Rs. 7.62 Lakhs
Scientists Involved	: D. K. Jigyasu, CSB-CMER&TI, PI (from 01.07.2022), Subadas Singh, CSB-CMER&TI, PI (upto 30.06.2022) S. A. S. Rahman, RSRS Boko, CI Vikram Kumar, MESSO, Rompara, Co-PI
Objectives	: 1. To study the effect of various host plants separately and in combination on the rearing performance of muga silkworm. 2. To study the various host plants separately and in combination with the grainage performance of muga silkworm.

Summary of the findings/achievements:

Muga silkworm rearing is conducted using two primary and two secondary food plants: Som (*Persea bombycina*), Soalu (*Litsea monopetala*), Dighloti (*Litsea salicifolia*), and Mejankori (*Litsea cubeba*), both individually and in combinations. The rearing and grainage performance is evaluated during the Jethua (April-May 2023), Kotia (October-November 2023), and Jarua (December 2023–January 2024) seasons. However, the Aherua (June-July 2023) and Bodhia (August-September 2023) crops were not completed due to unfertilized eggs and high temperatures and humidity in the previous crop. Results are presented in Tables 1 to 8.

The performance of muga silkworms reared on different host plants is as follows:

- Higher larval weight, cocoon weight, shell weight, pupal weight, silk ratio, and ERR were observed in silkworms reared on Som, Soalu, and their combinations.
- The highest mortality was recorded on Mejankari plants, while the lowest was on Dighloti.
- Hatching, pupation, and natural coupling rates were higher on Som and combinations of Som and Soalu.
- The highest fecundity was observed on Soalu.
- Egg retention was lowest on combinations involving Mejankari.
- The study concludes that the overall performance of muga silkworm rearing and grainage was better on Som and in combination with Soalu. These findings suggest that these combinations might be beneficial for enhancing the productivity of muga silkworms and could be tested further in other locations with similar conditions.





- Whereas, the combination found in the research may be tested at other locations at the institute level where Som, Soalu and Dighloti host plants are available on a large scale (OST).

Table 1: A pooled analysis of average data and Duncan Multiple Range Test of different treatments in pre-seed Crops (*Jarua* seasons)

Treatments	Larval Wt. (g) avg.	Cocoon Wt. (g) avg.	Shell Wt. (g) avg.	Pupal Wt. (g)	Silk Ratio (%)	Mortality (%)	ERR
SOM (SM)	8.39 ^a	4.88 ^a	0.39 ^a	4.5 ^a	7.98 ^{ab}	44.83 ^{de}	54.39 ^a
SOALU (SL)	8.37 ^a	4.41 ^{ab}	0.34 ^a	4.07 ^{ab}	7.82 ^{ab}	52.17 ^{bcd}	50.39 ^a
DIGHLOTI (DG)	6.33 ^{bcd}	3.44 ^{bcd}	0.24 ^a	3.2 ^{bcd}	7.03 ^{abcd}	37.00 ^e	39.56 ^{bc}
MEJANKARI (MJ)	5.32 ^{def}	3.33 ^{bcd}	0.21 ^a	3.13 ^{bcd}	6.27 ^{bcd}	71.00 ^a	36.95 ^{bc}
SM+SL	8.18 ^a	4.29 ^{abc}	0.34 ^a	3.95 ^{abc}	8.04 ^a	47.33 ^{cd}	52.39 ^a
SM+DG	6.18 ^{bcd}	3.17 ^{cde}	0.22 ^a	2.95 ^{bcd}	7.15 ^{abcd}	48.50 ^{bcd}	41.67 ^b
SM+MJ	5.10 ^{ef}	2.86 ^e	0.17 ^a	2.7 ^e	5.8 ^d	73.00 ^a	29.17 ^{de}
SL+SM	7.90 ^a	4.22 ^{abcd}	0.32 ^a	3.91 ^{abcd}	7.61 ^{abc}	49.33 ^{bcd}	51.28 ^a
SL+DG	5.26 ^{def}	3.05 ^{de}	0.20 ^a	2.85 ^{cde}	6.62 ^{abcd}	56.00 ^b	40.50 ^{bc}
SL+MJ	4.90 ^f	2.92 ^e	0.19 ^a	2.73 ^e	6.53 ^{abcd}	68.50 ^a	34.11 ^{cd}
DG+SM	6.84 ^b	3.80 ^{abcde}	0.25 ^a	3.55 ^{abcde}	6.73 ^{abcd}	55.00 ^{bc}	42.11 ^b
DG+SL	6.50 ^{bc}	3.71 ^{bcd}	0.25 ^a	3.47 ^{abcde}	6.75 ^{abcd}	55.67 ^b	33.61 ^{cd}
DG+MJ	5.75 ^{bcd}	2.99 ^e	0.22 ^a	2.78 ^{de}	7.23 ^{abcd}	75.83 ^a	25.61 ^e
MJ+SM	6.87 ^b	3.82 ^{abcde}	0.26 ^a	3.56 ^{abcde}	6.92 ^{abcd}	67.83 ^a	40.50 ^{bc}
MJ+SL	6.69 ^b	3.82 ^{abcde}	0.26 ^a	3.56 ^{abcde}	6.88 ^{abcd}	68.50 ^a	38.08 ^{bc}
MJ+DG	5.50 ^{cdef}	2.86 ^e	0.17 ^a	2.69 ^e	6.01 ^{cd}	74.50 ^a	25.67 ^e
Grand Mean	6.50	3.60	0.25	3.35	6.96	59.60	39.75
CD (5%)	0.36	0.37	0.034	0.35	0.81	6.86	1.75

Table 2: A pooled analysis of average data and Duncan Multiple Range Test of different treatments in pre-seed Crops (*Jarua* and *Aherua* seasons)

Treatments	Fecundity (No.)	Hatchling (%)	Pupation (%)	Natural Coupling (%)	Mechanical Coupling (%)	Potential Fecundity (No.)	Realized fecundity (No.)	Egg retained (No.)
SOM (SM)	147 ^{bc}	59.65 ^a	86	28	72	168	145	23
SOALU (SL)	210 ^a	52.62 ^{abc}	87	26	74	239	209	30
DIGHLOTI (DG)	107 ^{cd}	42.36 ^{cde}	80	15	85	123	101	23
MEJANKARI (MJ)	41 ^e	41.82 ^{cde}	72	17	83	65	46	19
SM+SL	148 ^{bc}	52.29 ^{abc}	84	25	75	166	145	21
SM+DG	87 ^{de}	42.04 ^{cde}	76	14	86	102	87	15
SM+MJ	73 ^{de}	48.99 ^{abcd}	81	21	79	89	77	12
SL+SM	169 ^{ab}	57.34 ^{ab}	82	24	76	183	162	21
SL+DG	114 ^{cd}	44.92 ^{cde}	81	22	78	124	109	15
SL+MJ	106 ^{cd}	36.09 ^e	75	13	88	115	106	9
DG+SM	72 ^{de}	40.27 ^{de}	77	14	86	95	81	14
DG+SL	120 ^{cd}	46.69 ^{bcd}	72	21	79	129	111	18
DG+MJ	73 ^{de}	35.60 ^e	72	0	100	91	72	19
MJ+SM	82 ^{de}	40.49 ^{de}	78	9	91	94	79	15
MJ+SL	98 ^d	40.77 ^{de}	79	17	83	121	104	17



MJ+DG	75 ^{de}	36.69 ^e	62	0	100	89	69	20
Grand Mean	108	44.91	78	17	100	124	106	18

Table 3: Pooled analysis of average rearing data and Duncan Multiple Range Test of different treatments in Seed Crops (Chatua and Bhodia seasons)

Treatments	Larval Wt. (g) avg.	Cocoon Wt. (g) avg.	Shell Wt. (g) avg.	Pupal Wt. (g)	Silk Ratio (%)	Mortality (%)	ERR
SOM (SM)	7.18 ^{bcd}	4.77 ^{ab}	0.43 ^a	4.34 ^{abc}	8.95 ^a	27.65 ^{fg}	53.45 ^a
SOALU (SL)	8.52 ^a	4.83 ^{ab}	0.41 ^{ab}	4.58 ^{ab}	8.35 ^{ab}	29.95 ^{ef}	44.55 ^{bc}
DIGHLOTI (DG)	6.52 ^{efgh}	3.68 ^{efgh}	0.25 ^{ef}	3.43 ^{fgh}	6.62 ^{cd}	22.62 ^g	37.33 ^{cd}
MEJANKARI (MJ)	5.85 ^j	3.43 ^{gh}	0.23 ^{ef}	3.20 ^{gh}	6.703 ^{cd}	65.17 ^{bc}	34.78 ^d
SM+SL	7.26 ^{bc}	5.13 ^a	0.36 ^{bc}	4.78 ^a	6.928 ^{cd}	28.72 ^{fg}	38.00 ^{cd}
SM+DG	6.27 ^{ghij}	3.21 ^h	0.23 ^{ef}	2.98 ^h	7.162 ^{bcd}	43.28 ^d	32.11 ^{de}
SM+MJ	6.04 ^{hij}	3.89 ^{defg}	0.27 ^{de}	3.63 ^{defg}	6.86 ^{cd}	78.40 ^a	21.77 ^f
SL+SM	7.40 ^b	4.32 ^{bcd}	0.33 ^c	3.98 ^{cde}	7.742 ^{abc}	33.62 ^{ef}	47.45 ^{ab}
SL+DG	6.63 ^{efg}	4.72 ^{abc}	0.32 ^{cd}	4.40 ^{abc}	6.737 ^{cd}	44.00 ^d	24.44 ^{ef}
SL+MJ	6.29 ^{ghij}	4.21 ^{cde}	0.27 ^{de}	3.94 ^{cdef}	6.335 ^d	76.33 ^a	23.78 ^f
DG+SM	6.92 ^{cde}	3.82 ^{defg}	0.26 ^{ef}	3.56 ^{efg}	6.808 ^{cd}	30.78 ^{ef}	35.89 ^d
DG+SL	6.10 ^{hij}	3.82 ^{defg}	0.28 ^{de}	3.55 ^{efg}	7.237 ^{bcd}	35.72 ^e	26.11 ^{ef}
DG+MJ	5.96 ^{ij}	3.52 ^{fgh}	0.23 ^{ef}	3.29 ^{gh}	6.632 ^{cd}	67.50 ^b	32.45 ^{de}
MJ+SM	6.43 ^{fghi}	4.19 ^{de}	0.28 ^{de}	3.91 ^{cdef}	6.635 ^{cd}	61.27 ^c	38.56 ^{cd}
MJ+SL	6.78 ^{def}	4.35 ^{bcd}	0.21 ^{fg}	4.14 ^{bcd}	4.63 ^e	76.67 ^a	23.44 ^f
MJ+DG	5.77 ^j	4.04 ^{def}	0.17 ^g	3.88 ^{cdef}	4.053 ^e	78.05 ^a	22 ^f
Grand Mean	6.62	4.12	0.28	3.85	6.78	49.98	33.50
CD (5%)	0.41	0.44	0.047	0.43	1.11	5.38	5.24

Table 4: Pooled analysis of average grainage data and Duncan Multiple Range Test of different treatments in Seed Crops (Chatua and Bhodia seasons)

Treatments	Fecundity (No.)	Hatching (%)	Pupation (%)	Natural Coupling (%)	Mechanical Coupling (%)	Potential Fecundity (No.)	Realized fecundity (No.)	Egg retained (No.)
SOM (SM)	143 ^b	60.33 ^a	86	33	67	169	143	26
SOALU (SL)	170 ^a	52.67 ^{abc}	85	28	72	198	170	28
DIGHLOTI (DG)	111 ^{cd}	32.00 ^d	77	19	81	135	112	24
MEJANKARI (MJ)	111 ^{cd}	46.33 ^{abcd}	71	24	76	129	111	18
SM+SL	120 ^{bc}	39.50 ^{cd}	89	28	72	145	121	25
SM+DG	112 ^{cd}	52.00 ^{abc}	74	9	91	132	113	20
SM+MJ	105 ^{cde}	54.83 ^{abc}	81	13	87	128	105	23
SL+SM	135 ^b	57.00 ^{ab}	79	28	72	162	136	26
SL+DG	126 ^{bc}	41.33 ^{bcd}	74	13	87	148	127	22
SL+MJ	96 ^{def}	44.33 ^{abcd}	62	8	92	113	97	17
DG+SM	109 ^{cd}	32.50 ^d	81	23	77	127	110	17
DG+SL	123 ^{bc}	40.00 ^{cd}	70	22	78	143	123	20
DG+MJ	95 ^{def}	48.17 ^{abcd}	75	22	78	120	96	24
MJ+SM	87 ^{ef}	40.17 ^{cd}	77	15	85	108	87	22
MJ+SL	106 ^{cde}	38.50 ^{cd}	70	0	100	123	106	17
MJ+DG	75 ^f	41.00 ^{bcd}	62	0	100	95	75	20
Grand Mean	114	45.02	76	18	82	136	114	22



Table 5: Pooled analysis of average rearing data and Duncan Multiple Range Test of different treatments in Commercial Crop (Jethua season, April-May)

Treatments	Larval Wt. (g) avg.	Cocoon Wt. (g) avg.	Shell Wt. (g) avg.	Pupal Wt. (g)	Silk Ratio (%)	Mortality (%)	ERR
SOM (SM)	10.17 ^a	6.22 ^a	0.51 ^b	5.71 ^a	8.31 ^{ab}	42.67 ^{cde}	57.00 ^a
SOALU (SL)	10.42 ^a	6.37 ^a	0.57 ^a	5.80 ^a	8.96 ^a	49.17 ^{cd}	50.50 ^b
DIGHLOTI (DG)	7.64 ^{cdef}	4.84 ^{efgh}	0.33 ^{cd}	4.52 ^{de}	6.78 ^d	35.00 ^e	45.33 ^c
MEJANKARI (MJ)	8.01 ^{cd}	4.50 ^{fghi}	0.31 ^d	4.2 ^{ef}	6.75 ^d	67.33 ^b	34.17 ^{ef}
SM+SL	9.22 ^b	5.76 ^b	0.49 ^b	5.27 ^b	8.55 ^{ab}	50.67 ^c	49.33 ^{bc}
SM+DG	6.63 ^h	4.10 ⁱ	0.30 ^{de}	3.8 ^f	7.40 ^{cd}	43.17 ^{cde}	25.17 ^{hi}
SM+MJ	6.42 ^h	4.28 ⁱ	0.28 ^{def}	4.01 ^f	6.82 ^d	80.00 ^a	22.33 ⁱ
SL+SM	8.89 ^b	4.89 ^{defg}	0.37 ^c	4.52 ^{de}	7.73 ^{bc}	50.17 ^{cd}	55.17 ^a
SL+DG	6.89 ^{gh}	4.80 ^{efgh}	0.27 ^{def}	4.53 ^{de}	5.64 ^e	42.67 ^{cde}	40.67 ^d
SL+MJ	7.34 ^{efg}	4.35 ⁱ	0.32 ^{cd}	4.04 ^f	7.26 ^{cd}	71.83 ^{ab}	29.33 ^{gh}
DG+SM	8.14 ^c	5.27 ^{cd}	0.37 ^c	4.91 ^{bcd}	6.94 ^{cd}	43.17 ^{cde}	37.00 ^{de}
DG+SL	7.53 ^{def}	4.47 ^{fhi}	0.31 ^d	4.17 ^{ef}	7.28 ^{cd}	39.83 ^{de}	25.33 ^{hi}
DG+MJ	7.19 ^{fg}	4.89 ^{def}	0.25 ^{ef}	4.65 ^d	5.08 ^{ef}	73.00 ^{ab}	27.67 ^{ghi}
MJ+SM	7.79 ^{cde}	5.22 ^{cde}	0.30 ^{de}	4.93 ^{bcd}	5.73 ^e	69.83 ^b	36.17 ^{de}
MJ+SL	7.76 ^{cde}	5.41 ^{bc}	0.28 ^{def}	5.14 ^{bc}	5.10 ^{ef}	69.50 ^b	31.17 ^{fg}
MJ+DG	6.83 ^{gh}	5.07 ^{cde}	0.22 ^f	4.86 ^{cd}	4.22 ^f	68.33 ^b	27.17 ^{ghi}
Grand Mean	7.93	5.03	0.34	4.69	6.78	56.02	37.09
CD (5%)	0.09	0.35	0.036	0.34	0.75	8.72	4.19

Table 6: Pooled analysis of average grainage data and Duncan Multiple Range Test of different treatments in Commercial Crop (Jethua season, April-May)

Treatments	Fecundity (No.)	Hatching (%)	Pupation (%)	Natural Coupling (%)	Mechanical Coupling (%)	Potential Fecundity (No.)	Realized fecundity (No.)	Egg retained (No.)
SOM (SM)	157 ^b	69.23 ^a	93	28	72	180	158	23
SOALU (SL)	170 ^a	71.64 ^a	90	26	74	196	170	26
DIGHLOTI (DG)	112 ^{de}	53.48 ^b	82	14	86	137	112	25
MEJANKARI (MJ)	122 ^c	52.11 ^b	71	16	84	150	123	27
SM+SL	105 ^e	68.22 ^a	92	23	77	127	105	22
SM+DG	76 ^{hi}	51.31 ^b	53	9	91	94	76	18
SM+MJ	39 ^j	49.85 ^b	82	18	82	59	40	19
SL+SM	118 ^{cd}	72.11 ^a	86	24	76	139	119	21
SL+DG	44 ^j	42.06 ^{cd}	86	10	90	57	44	13
SL+MJ	66 ⁱ	40.63 ^{cde}	71	13	87	85	67	18
DG+SM	89 ^{fg}	43.22 ^c	89	13	87	109	89	20
DG+SL	89 ^{fg}	51.64 ^b	62	14	86	110	90	21
DG+MJ	50 ^j	37.65 ^{de}	76	0	100	73	51	22
MJ+SM	94 ^f	44.15 ^c	79	12	88	117	95	23
MJ+SL	50 ^j	41.97 ^{cd}	82	5	95	75	50	25
MJ+DG	84 ^{gh}	36.37 ^e	62	0	100	114	84	30
Grand Mean	92	51.60	78	14	86	114	92	22

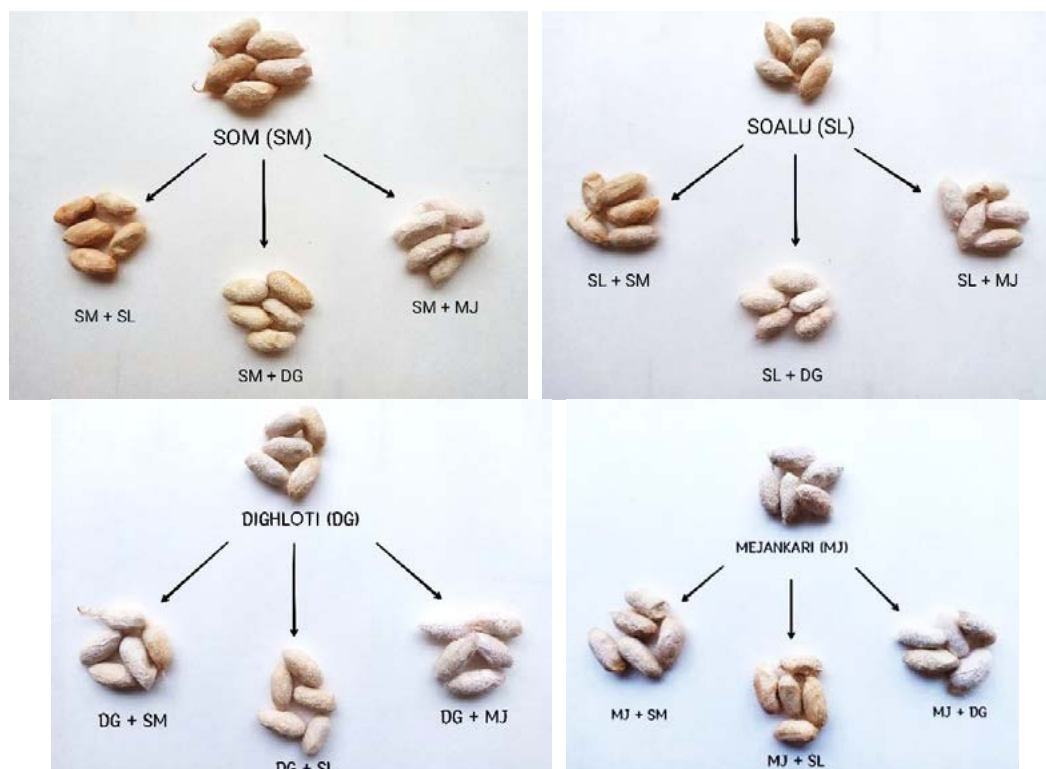


Table 7: Pooled analysis of average rearing data and Duncan Multiple Range Test of different treatments in Commercial Crop (Kotia season, October-November)

Treatments	Larval Wt. (g) avg.	Cocoon Wt. (g) avg.	Shell Wt. (g) avg.	Pupal Wt. (g)	Silk Ratio (%)	Mortality (%)	ERR (%)
SOM (SM)	10.55 ^a	7.38 ^a	0.57 ^a	6.82 ^a	7.8 ^{abc}	48.83 ^d	51.70 ^a
SOALU (SL)	9.67 ^{bc}	5.78 ^c	0.48 ^b	5.3 ^c	8.52 ^a	53.83 ^{cd}	44.25 ^b
DIGHLOTI (DG)	7.37 ^{efg}	4.89 ^{ef}	0.35 ^{efg}	4.54 ^c	7.26 ^{bcde}	35.5 ^e	34.26 ^{de}
MEJANKARI (MJ)	6.94 ^{fg}	4.13 ⁱ	0.29 ^g	3.84 ^g	7.04 ^{bcde}	73.17 ^{ab}	27.74 ^{efgh}
SM+SL	10.05 ^{ab}	6.57 ^b	0.46 ^{bc}	6.11 ^b	7.1 ^{bcde}	59.17 ^c	41.26 ^{bc}
SM+DG	8.26 ^d	5.37 ^d	0.42 ^{cd}	4.95 ^{cd}	7.91 ^{abc}	51 ^d	37.20 ^{cd}
SM+MJ	6.81 ^g	4.56 ^{fghi}	0.35 ^{efg}	4.21 ^{efg}	7.7 ^{abcd}	67.83 ^b	30.74 ^{def}
SL+SM	9.26 ^c	5.02 ^{de}	0.38 ^{def}	4.64 ^{de}	7.64 ^{abcd}	50.5 ^d	43.26 ^{bc}
SL+DG	7.42 ^{ef}	4.57 ^{fghi}	0.36 ^{ef}	4.22 ^{efg}	7.75 ^{abc}	39.83 ^e	32.24 ^{def}
SL+MJ	6.98 ^{fg}	4.63 ^{efgh}	0.29 ^g	4.34 ^{ef}	6.1 ^e	72.17 ^{ab}	26.76 ^{efgh}
DG+SM	8.18 ^d	4.95 ^{ef}	0.34 ^{fg}	4.61 ^{de}	6.86 ^{cde}	40.5 ^e	34.24 ^{de}
DG+SL	7.72 ^{de}	4.98 ^{def}	0.4 ^{de}	4.58 ^{de}	8.05 ^{ab}	35.17 ^e	30.25 ^{efg}
DG+MJ	6.73 ^g	4.22 ^{hi}	0.33 ^{fg}	3.89 ^g	7.74 ^{abc}	75.83 ^a	23.75 ^{gh}
MJ+SM	8.07 ^d	4.79 ^{efg}	0.34 ^{fg}	4.46 ^{ef}	7.08 ^{bcde}	72.5 ^{ab}	26.24 ^{fgh}
MJ+SL	7.94 ^{de}	4.87 ^{ef}	0.35 ^{efg}	4.52 ^{ef}	7.27 ^{bcde}	71.83 ^{ab}	27.26 ^{fgh}
MJ+DG	6.74 ^g	4.4 ^{ghi}	0.29 ^g	4.11 ^{fg}	6.56 ^{de}	77.5 ^a	21.21 ^h
Grand Mean	8.04	5.07	0.37	4.70	7.40	57.82	33.28
CD (5%)	0.51	0.35	0.04	0.35	0.93	5.47	5.63

Table 08: Pooled analysis of average grainage data and Duncan Multiple Range Test of different treatments in Commercial Crop (Kotia season, October-November)

Treatments	Pupation (%)	Natural Coupling (%)	Mechanical Coupling (%)	Egg retained (%)	Fecundity (No.)	Hatching (%)
SOM (SM)	85	35	65	10	182 ^{ab}	73.06 ^a
SOALU (SL)	82	27	73	10	203 ^a	61.68 ^{abc}
DIGHLOTI (DG)	81	0	100	12	108 ^{efg}	57.77 ^{bcde}
MEJANKARI (MJ)	71	17	83	16	106 ^{efg}	55.63 ^{cde}
SM+SL	73	27	73	11	168 ^{bc}	58.86 ^{bcd}
SM+DG	68	0	100	10	147 ^{cd}	53.49 ^{cde}
SM+MJ	61	17	83	19	106 ^{efg}	47.73 ^{de}
SL+SM	78	33	68	10	176 ^{abc}	68.75 ^{ab}
SL+DG	65	0	100	12	121 ^{def}	52.32 ^{cde}
SL+MJ	54	0	100	12	90 ^{fg}	46.61 ^{de}
DG+SM	62	42	58	13	118 ^{def}	47.87 ^{de}
DG+SL	61	25	75	11	133 ^{de}	50.36 ^{cde}
DG+MJ	58	50	50	11	101 ^{efg}	51.12 ^{cde}
MJ+SM	53	25	75	12	104 ^{efg}	51.31 ^{cde}
MJ+SL	51	50	50	15	90 ^{fg}	45.56 ^{de}
MJ+DG	63	0	100	19	77 ^g	43.91 ^e
Grand Mean	67	22	78	10	127	54.12



Muga silk cocoons produced from different host plants

- Project Code** : APR 5022 MI
- Project Title** : Evaluation and popularization of improved technologies developed in the field of Muga, Eri and Oak sector for Northeastern India (for validation of technology at CSB institutes/ RSRs/ DoS units etc.)
- Project Period** : March 2021 to February 2024
- Funding Agency** : Central Silk Board, Bengaluru
- Budget Allocation** : Rs. 36.02 Lakhs
- Scientists Involved** : D. K. Jigyasu, CSB-CMER&TI, PI
 CIs: Suraj Pal, REC, Fatehpur, Uttar Pradesh; Reeta Luikham, CSB-CMER&TI; James T Keisa, CSB-CMER&TI; Yumnam Debaraj, RSRS, Imphal; L. Somen Singh, RSRS, Imphal; Bidyut Nath Choudhury, RSRS Boko; SAS Rahman, RSRS Boko; Diganta Mech, CSB-CMER&TI; Aftab A Shabnam, CSB-CMER&TI; Sinam Subharani Devi, RSRS, Imphal; Arun Kumar KP, CSB-CMER&TI; Kh. Subadas Singh, RSRS, Imphal; Vijay. N, CSB-CMER&TI; Mahesh D S, CSB-CMER&TI; Manjunath R N, CSB-CMER&TI; Abhishek Singh, CSB-MESSO
- Objectives** :
1. To popularize various technologies in different stages developed by the Institute.
 2. To further create awareness for technological intervention among the farmers and beneficiaries.
 3. To increase the overall cocoon production.

**Summary of the findings/achievements:**

10 OSTs and 11 OFTs have been carried out as per milestones and season/crop-wise at the Institute's and farmer's level.

- Multi-location trials of muga breeds CMR-1 & CMR-2 were conducted at six test centres during two commercial seasons in 2022 and 2023. Muga breeds CMR-1 and CMR-2 did not show significant improvement in the characters studied (except for a few comparisons). Also, the characteristics were not better than set norms/benchmarks.
- It was observed that larval weight and cocoon weight of cross hybrids i.e. GBS x GBZ and YP x GBZ were found to increase as compared with the C2 breed (Control). However, there was no significant difference between hybrids. The overall performance showed that the C2 breed was found better in terms of ERR, shell weight, and shell ratio in comparison with cross hybrids.
- Under the development of seed preservation technology for the Muga silkworm, 71 & 72% of the hatching percentage recorded in 18 days preserved muga seed against the control of 82 & 79%.
- Validation of Muga silkworm egg treatment for uniform hatching and higher survivability of young larvae was conducted at four locations. The OST trials have concluded, indicating that the heat-treated batch did not exhibit superior observations in terms of uniform hatching, hatching (%), survivability (%), and ERR (%) percentage compared to the control.
- Rearing management of Muga silkworm in cooler regions during summer was conducted at Koraput, Orissa, Chintapalle, Andhra Pradesh, Kaying, Arunachal Pradesh, Kalimpong, West Bengal, Jorhat – Control (Warm region). The results showed that muga can be reared outside of the Northeast region and these areas can be exploited for seed and pre-seed rearing during June-Sep.
- Under the trial of formulated volatiles application for enhancing egg laying capacity of Muga silk moth during the commercial crop, 11.4% improvement was recorded in blend treated batch as against the control of 12.8% egg enhancement per kg of cocoons.
- Trials of formulated volatiles application for enhancing egg laying capacity of Eri silk moth during commercial crop were carried out at two locations. Around 10–11% improvement was recorded in blend treated batch as against the control.
- On-station trials of Muga Super Cook formulation were conducted in nine locations. The results are in co-relation with the outcome of the project and will be taken further for wider popularization among the beneficiaries (through OFT under Action Plan 2024-25).
- On-station trials of Honey comb mountages for Muga cocoons were conducted and compared with traditional jali (dry leaves of plants). Results highlighted the 90% Cocoonage, 497 m filament length and 50.30% recovery of silk.





- More than 9000 seedlings of the superior host plants of muga and eri silkworm have been supplied to 256 beneficiaries in upper and lower Assam and Nagaland. This has supported augmenting the plantation of superior host plant accessions at farmers' fields of about 20 acres. More than 86% of seedlings were successfully established at farmers' fields.
- The completed trials have revealed a significant improvement of 20-40% in hatching rates with the new Eri egg incubation device compared to the control batch. This notable enhancement can be attributed to the maintenance of optimal temperature and humidity levels within the new device. These findings align closely with the observations made during the project's investigation into egg incubation.
- Under the trial of technology to control the bacterial flacherie disease in Muga silkworm, 50 farmers have been covered and recorded an improvement in ERR to 27.5% as against 22.9% control.

Conducted on-site demonstrations of eri chawki worms in various regions of Assam and Nagaland. Recorded a significant increase in cocoon yield in chawki-reared batches (over 20%) compared to conventional rearing practices adopted by farmers in the same region.

On Station Trials

Sl.	Name of the Technology	Main Institute	RSRS	DOS Units	Findings
1	Multi-location trials of muga breeds CMR-1 & CMR-2	01	05	-	The new breeds CMR-1 and CMR-2 were on par with the farmer cultivated muga silkworms.
2	Multi-location trials of Eri breeds/crossbreeds	01	-	09	With race purity and infections, valuable insights were gained, paving the way for more refined and successful future studies.
3	Popularization of Eri C2 breed and Borduar eco-race in Manipur	--	02	03	The trials were promising to further popularize Eri C2 breed and borduar eco-race in Manipur.
4	Development of seed preservation technology for Muga silkworm	02	-	-	85% hatching was observed by following the recommended seed preservation technology.
5	Validation of muga silkworm egg treatment for uniform hatching and higher	03	01	-	The batch of muga eggs subjected to heat treatment did not exhibit positive outcomes in terms of uniform hatching





	survivability of young larvae				and survivability compared to the control batch.
6	Rearing management of Muga silkworm in cooler region during summer	01	05	-	The cooler regions in Mizoram, Arunachal and Odisha can be utilized for seed rearing during summer months.
7	Trial of formulated volatiles application for enhancing egg laying capacity of Muga moth during commercial crop.	01	01	-	The trials were promising to further adopt the application of the volatile formulation in enhancing egg laying capacity in Muga moth.
8	Trial of formulated volatiles application for enhancing egg laying capacity of Eri moth during commercial crop.	01	01	-	The trials were promising to further adopt the application of the volatile formulation in enhancing egg laying capacity in Eri moth.
9	Trial of Muga Super Cook formulation	02	02	05	The formulation was effective in cooking and improved reeling performance in Muga cocoons.
10	Trial of Honey comb mountages for Muga	01	01	00	In large scale trials, the cocoons produced were at par with other techniques.

On Farm Trials

SI	Name of the Technology	No. of stakeholders	Findings
1	Popularization of Kessuru Eri host plant HF005 and HF008	400	A total of 2515 superior variety of host plants seedlings were distributed to farmers.
2	Popularization of Borpat Eri host plant		
3	Popularization of other host Plants (Som, Dighloti and Castor)		
4	Evaluation and popularization of Eri egg incubation device	30	15-20% improvement in hatching in new eri egg incubation device over the control.
5	Formulation for controlling bacterial flacherie disease in Muga silkworm	50	Average ERR improved to 27.5% as against 22.9% in control.





6	Popularization of eri chawki rearing technology in the farmers field	100	Significant increase in the cocoon yield in chawki reared batch (>20%) over the conventional rearing carried by the farmers.
7	Establishment & popularization of new breed C27 among farmers.	15	Rearing performance of C-27 breed recorded 36-41 cocoons per dfl as against 27-30 cocoons per dfl in A. proylei (control).
8	Validation of use of PET bottles for uzi trap in oak tasar silkworm rearing	30	First trial is conducted at 3 locations and covered 20 farmers.
9	Validation of use of Sodium hypo-chlorite for seed treatment against tiger band disease of oak tasar silkworm.	15	Rearing performance of 0.2% sodium hypochlorite treated lot recorded 38-43 cocoons per dfl as against 26-30 cocoons per dfl in control.
10	Validation of IPM technology for control of uzi fly in oak tasar culture	15	Recorded 70-75 % reduction of insect pest infesting Q. serrata.
11	Validation of use of Biopesticides for control of insect pest infesting Q. serrata.	15	Percentage of uzi infestation recorded was 5 to 7 % with IPM as against 12 to 16 % in control.





ONGOING PROJECTS

Project Code	: AIP-05013-SI
Project Title	: Impact of elevated CO₂ and Temperature in muga Silkworm and its primary host plants
Project Period	: March 2020 to February 2025
Funding Agency	: Central Silk Board, Bengaluru
Budget Allocation	: Rs. 44.72 Lakhs
Scientists Involved	: D. K. Jigyasu, PI Amit Kumar, CI (PI up to 31.07.2022) Aftab A. Shabnam, CI G. Subramanyam (CI up to 26.07.2021)
Objectives	: 1. To assess the influence of elevated CO₂ and temperature on growth and yield attributes of the primary host plant (Som). 2. To assess the impact of elevated CO₂ and temperature on muga seed crop production, cocoon characteristics and fecundity. 3. To design strategies for adoption in muga silkworm rearing under the changing environmental scenario in Assam.

Summary of the findings/achievements:

- Treatment of elevated CO₂ (550 ppm) and elevated temperature (1.5 °C + ambient) on Som plants is given as per revised milestones.
- The treatments are proceeding according to the established plan, and continuous monitoring and data recording are continued. Leaf area damage of som plants was recorded under the OTCs.
- The seed crop rearing performance of muga silkworm was carried out in the Bhodia (August-September, 2023) and Jarua (January-February 2024) crops seasons.
- Changes in biochemical properties of the muga silkworm, cocoon and seed production have been recorded.
- The data reveals distinct patterns in silkworm rearing and grainage performance under different treatments i.e. OTC-1 (CO₂), OTC-2 (Temp), OTC-3 (eCO₂+Temp) and OTC-4 (Control).



- Elevated CO₂ at 550 ppm in OTC-1 shows moderate larval and cocoon weights across all rearings, with relatively high mortality and varying ERR. Elevated temperature in OTC-2 (1.5 °C + ambient) showed improved cocoon and shell weights compared to eCO₂ alone, with lower mortality rates and ERR (Fig. 1 and 2). OTC-3 (eCO₂+Temp), consistently produced higher cocoon and shell weights, higher shell ratios, and the lowest mortality rates have been recorded, indicating a synergistic effect beneficial for silkworm rearing.
- In control OTC-4, the highest larval weights were recorded but showed mixed results in terms of cocoon weight, shell weight, and shell ratio. Mortality rates are generally higher, and ERR is more variable.
- After the completion of three rearing experiments, it is suggested that a combination of elevated temperature and elevated CO₂ may provide the most favourable conditions for Muga silkworm rearing, optimizing cocoon and shell production while maintaining lower mortality rates.
- The leaf area damage (LAD %) of Som plants leaves is recorded after the treatment of 6 months, 12 months and 18 months in the Open Top Chambers (OTCs) (Fig. 3). The results indicate that OTC-3 (eCO₂+Temp) consistently experiences the highest leaf area damage across most treatment durations, suggesting it is the most susceptible to disease and pest incidence. The OTC-4 (control) shows variability, initially having the least damage but increasing significantly over time. The LAD in OTC-1 (eCO₂) appears to improve over time, with reduced damage by the 18-month mark, while OTC-2 shows a steady increase in leaf area damage, peaking at the 18-month treatment.
- Plant growth attributes of Som plants in OTCs have been recorded and found that significant reductions in protein content across all OTCs, with the least impact under control OTC. After the 12 months of treatments, variability in protein content changes, with increases observed under elevated temperature in OTC-2 (1.5 °C + ambient).
- These results highlight the influence of elevated CO₂ and temperature separately and in combinations on carbohydrate accumulation in Som plant leaves over time, with notable differences in how each OTCs affects carbohydrate stability and overall plant health (Fig. 4). The carbohydrate content is increased in all chambers with highest increase showing in control (OTC-4) chamber.
- Carbohydrate content generally continued to increase, particularly under CO₂ treatment (OTC-1) and ambient conditions (OTC-4), though temperature stress (OTC-2) resulted in a reduction after one year of treatment.
- After 18 months of treatments on Som plants, CO₂ treatment (OTC-1) showed the highest carbohydrate levels, followed by combined CO₂ and temperature treatment (OTC-3). Temperature treatment (OTC-2) showed a slight recovery, while ambient conditions (OTC-4) exhibited a significant reduction.



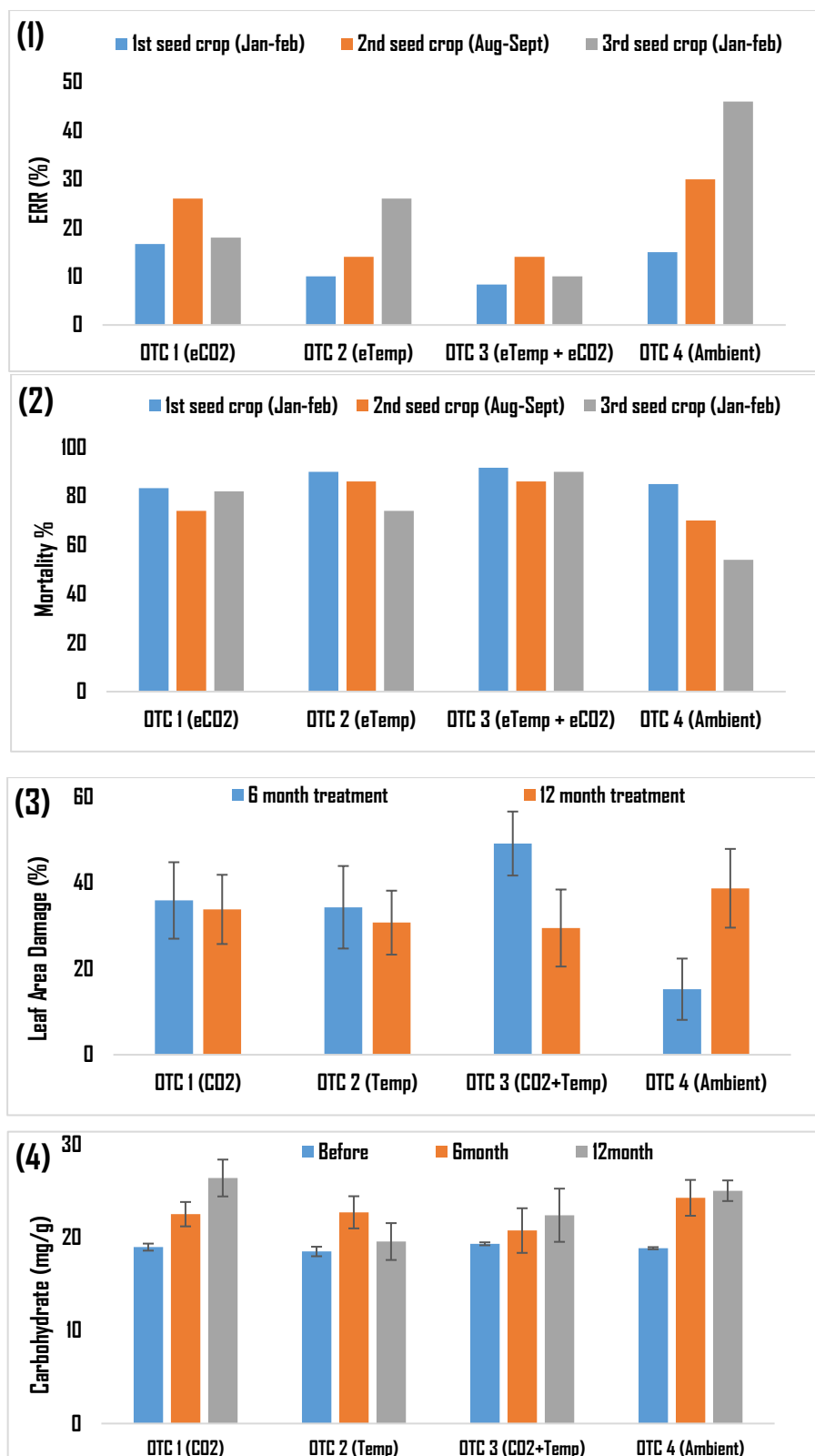


Fig.: Graph showing the (1) effective rate of rearing (%), (2) mortality (%), (3) leaf area damage (%) and (4) carbohydrate content in Som plants leaves under the different treatments and control. Results were compared between different seed crop seasons and open tom chambers.



Project Code	: PIB 05025 SIC
Project Title	: Characterization and evaluation of soalu (<i>Litsea monopetala</i>) accessions for muga silkworm (<i>Antheraea assamensis</i>) rearing
Project Period	: February 2024 – February 2027
Funding Agency	: Central Silk Board, Bangalore
Budget Allocation	: 57.82 Lakhs
Scientists Involved	: O. P. Patidhar, PI Aftab A. Shabnam, CI D. K. Jigyasu, CI
Objectives	: 1. Collection and maintenance of different ecoraces and strains of Eri silkworms. 2. Genotyping by Sequencing of selected ecoraces and strains of eri silkworms. 3. Analysis of SNP data for use in different downstream applications for the improvement of Eri silkworm.

Summary of the findings/achievements: The project was recently coded (February 2024).

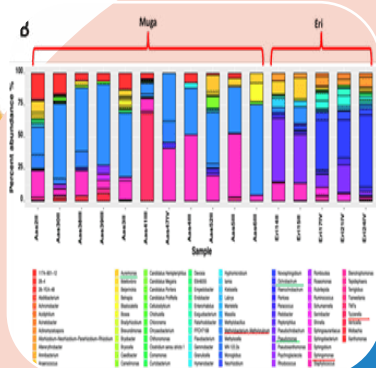
Project Code	: PIT 05029 SIC
Project Title	: Development of clonal propagation methods in Borpat (<i>Ailanthus grandis</i> L.) for its mass multiplication.
Project Period	: March 2024 – February 2027
Funding Agency	: Central Silk Board, Bangalore
Budget Allocation	: 57.82 Lakhs
Scientists Involved	: Arun Kumar KP, PI Bitupan Das, CI Mahesh DS., CI
Objectives	: 1. Collection and maintenance of different ecoraces and strains of Eri silkworms. 2. Genotyping by Sequencing of selected ecoraces and strains of eri silkworms. 3. Analysis of SNP data for use in different downstream applications for the improvement of Eri silkworm.

Summary of the findings/achievements: The project was recently coded (March 2024).





जैव-प्रौद्योगिकी विभाग BIOTECHNOLOGY DIVISION





ONGOING PROJECTS:

Project Code	: AIT 05024 EF
Project Title	: Advanced level Institutional Biotech hub at CMER&TI, Jorhat. Phase (II)
Project Period	: February 2023 – February 2026
Funding Agency	: Dept. of Biotechnology, Govt. of India
Budget Allocation	: 57.82 Lakhs
Scientists Involved	: Arun Kumar K.P., PI Bitupan Das., CI Mahesh DS., CI

Objectives	: 4. Collection and maintenance of different ecoraces and strains of Eri silkworms. 5. Genotyping by Sequencing of selected ecoraces and strains of eri silkworms. 6. Analysis of SNP data for use in different downstream applications for the improvement of Eri silkworm.
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Summary of the achievements:

Survey and collection of ecoraces

Nine ecoraces of Eri silkworm i.e. Lakhimpur (SR012), Kokrajhar (SR014), Borduar (SR001), Dhansiripar (SR020), Diphu (SR010), Mendipathar (SR005), Titabar (SR002), Lahing (SR008) and Namti have been collected and rearing of the collected silkworms is going on at the Institute.

Purification of strains from the collected ecoraces

Each of the strains from the collected ecoraces was purified using the cellular rearing method and is maintained separately at the Institute. (Figure 1)

Collection of wild eri (Samia canningi) cocoons.

During the field surveys, wild eri (*S. canningi*) silkworms were collected and reared at the institute. Grainage was conducted from the collected cocoons after rearing. The silkworms are currently being maintained at the institute. (Figure 2)

Identification of default larval phenotype

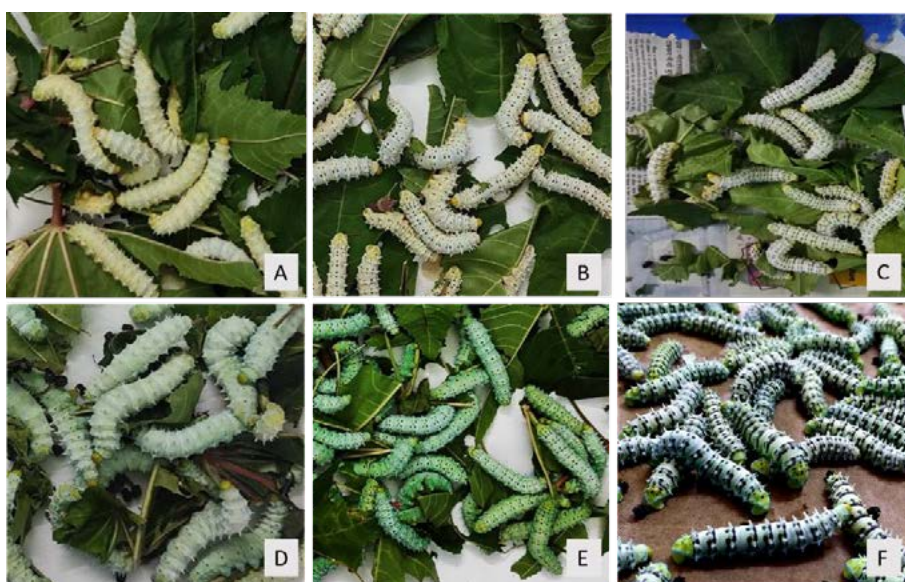
From the experiments conducted during rearing, it was found that the default larval colour of eri silkworm is Yellow and the gene responsible for it is recessive. In the case of larval markings, the plain phenotype is the default and recessive. The larval phenotype Yellow Plain gets expressed only when no gene for Greenish Blue colour and Spotted / Zebra larval marking is present. (Figures 3 and 4). Eri silkworms with small dots on the body were observed from Namti and Diphu ecorace (Figure 5A) and silkworms with small dots on the legs were observed from the Diphu ecorace (Figure 5B) both of which were not reported earlier.





Training and outreach activities

Training programs have also been conducted as per the work plan. Two 5-day in-house molecular biology training programs for postgraduate students of PG colleges in the upper Assam area during this financial year were conducted. A five-day biotechnology training program for postgraduate college faculty members in the upper Assam region was also conducted. However, an outreach program centred around tissue culture plant entrepreneurship development could not be conducted due to the election code of conduct. Hands-on training sessions on Agarose gel electrophoresis, DNA extraction, Plasmid DNA extraction, Restriction digestion, and Reverse transcriptase PCR were conducted and lectures on subjects like Biotechnology in sericulture, Tissue culture techniques, gene manipulation technique, biological sequence analysis, and marker-assisted selection were also presented to the participants. Guest lecturers from CSIR- NEIST, Jorhat and RFRI, Jorhat gave talks on biological sequence analysis, gene manipulation techniques and tissue culture techniques. Apart from guest lecturers house scientists of CSB-CMER&TI also delivered talks on Biotechnology in sericulture, Marker Assisted Selection, Gene manipulation techniques and biological sequence analysis.

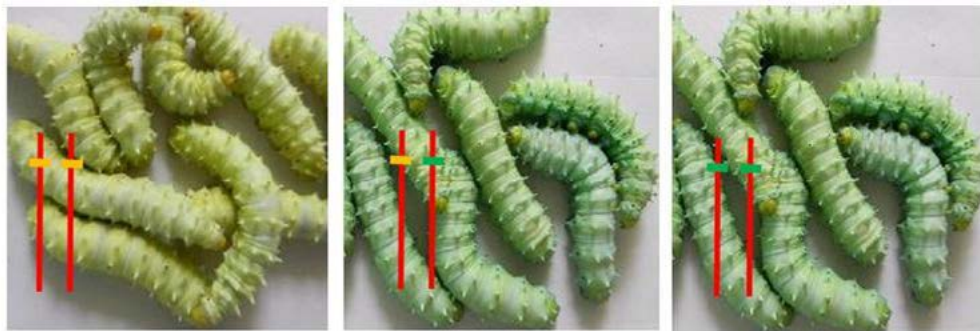


Larval phenotypes of eri silkworm. (A) Yellow Plain, (B) Yellow Spotted, (C) Yellow Zebra, (D) Greenish Blue Plain (GBP), (E) Greenish Blue Spotted (GBS), (F) Greenish Blue Zebra (GBZ).



Cocoon collected from (A) Wild eri silkworm (*Samia canningi*) and (B) Domesticated eri silkworm (*Samia ricini*)





Yellow Plain (YP)

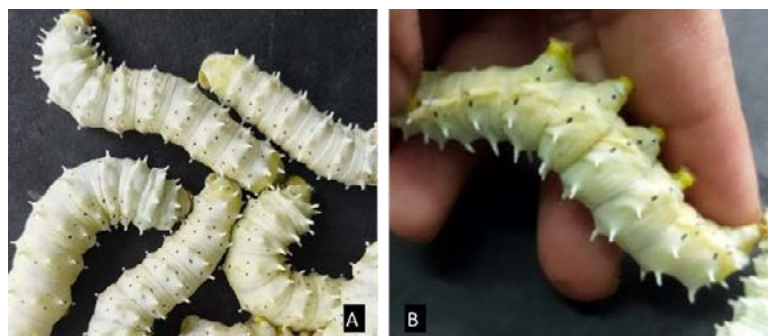
Greenish Blue Plain (GBP)

Greenish Blue Plain (GBP)

Larval Body Colour Blue is dominant and Yellow is the default color.



Larval marking is dominant and Plain is the default.



Images showing silkworms collected from Diphu and Namti show (A) Small dots on the larval body and (B) Small dots on the legs.



रेशम उत्पादन विस्तार, आर्थिक और प्रबंधन विभाग

SERICULTURE EXTENSION, ECONOMICS & MANAGEMENT DIVISION



**ONGOING PROJECTS:** (Newly initiated projects)

Project Code : SPR 5026 SIC
Project Title : Development of suitable Muga and Eri based Integrated Farming System (IFS) for North East India
Project Period : February 2024 to July 2026
Funding Agency : Central Silk Board, Bengaluru
Budget Allocation : Rs. 35.80 Lakhs
Scientists Involved : Diganta Mech, PI
 Vijay N, CI

Objectives : 1. To identify muga and eri based IFS at farmers level in different locations of North East India.
 2. To develop suitable muga and eri based IFS model through assessment of yield and economics per unit area.

Summary of the findings/achievements: The project was recently coded (February 2024).

Project Code : MOE 5027 SIC
Project Title : Economic analysis of Tapioca based Eri-culture in Assam & Nagaland
Project Period : March 2020 to February 2024
Funding Agency : Central Silk Board, Bengaluru
Budget Allocation : Rs. 13.50 Lakhs
Scientists Involved : Vijay N, PI
 Diganta Mech, CI

Objectives : 1. To assess the impact of different percentage of leaf utilization on tuber production and eri rearing performance in Assam & Nagaland.
 2. Economic analysis of tapioca cultivation with respect to eri culture.

Summary of the findings/achievements: The project was recently coded (March 2024).





EXTENSION COMMUNICATION PROGRAMMES OF CMERTI LAHDOIGARH FOR 2023-24

Organization of Vanya Reshom Krishimela

In the year 2023-24, the Central Muga Eri Research & Training Institute (CMER&TI) in Lahdoigarh organized two significant Vanya Reshom Krishimelas in Assam to promote awareness and adoption of the latest technologies among muga and eri farmers. These events were strategically held in two different districts to maximize outreach and impact. CSB-CMER&TI honoured progressive farmers from each district for their outstanding contributions to the sericulture industry. These acknowledgements served to motivate other farmers by showcasing the tangible benefits of adopting advanced sericulture practices. The recognized farmers shared their success stories and techniques, providing practical insights and inspiration to their peers.

Krishimela in Khowang, Dibrugarh District

The first Krishimela was held on January 24, 2024, in Khowang, located in the Dibrugarh district. This event was a resounding success, drawing over 500 participants, including eri and muga farmers, entrepreneurs, officials from the sericulture department, social workers, and other stakeholders. The primary goal was to introduce and disseminate the latest advancements in sericulture to enhance productivity and sustainability. The high turnout reflected the strong interest and commitment of the local community to the sericulture industry.

Krishimela in Sukafa, Charaideo District

Following the success in Dibrugarh, the second Krishimela took place on February 19, 2024, at Sukafa in the Charaideo district. This event saw the participation of 250 farmers, who were eager to learn about innovative practices and technologies to improve their sericulture operations. The event provided a platform for knowledge exchange and networking among farmers and industry experts.

RSRS, Boko's Krishimela in Nongpoh, Meghalaya

Additionally, the Regional Sericulture Research Station (RSRS) in Boko organized a Reshom Krishimela in Nongpoh, Meghalaya, on February 8, 2024. This event attracted over 200 farmers, further extending the reach of technological advancements in sericulture to a broader audience. The Nongpoh Krishimela emphasized the regional diversity in sericulture practices and addressed specific local challenges faced by farmers in Meghalaya.





KRISHI MELA OF CSB-CMER&TI, LAHDOIGARH AT DIBRUGARH





KRISHI MELA OF CSB-CMER&TI, LAHDOIGARH AT CHARAIDEO





KRISHIMELA OF RSRs, BOKO





ORGANIZATION OF WORKSHOPS

In celebration of the Platinum Jubilee of the Central Silk Board in 2023-24, the Central Muga Eri Research & Training Institute (CMER&TI) in Lahdoigarh organized a series of impactful events aimed at advancing the sericulture industry and empowering its stakeholders.

Workshop on "Empowering Women Entrepreneurs in Eri Culture"

On November 29, 2023, CSB-CMER&TI hosted a significant workshop titled "Empowering Women Entrepreneurs in Eri Culture." This event aimed to support and uplift women engaged in eri culture, recognizing their vital role in the sericulture industry. Approximately 200 women farmers from various regions participated actively, showcasing their enthusiasm and commitment to enhancing their skills and knowledge. The workshop featured sessions on advanced eri culture techniques, business management, and sustainable practices, delivered by experts in the field. The event also included interactive discussions, practical demonstrations, and networking opportunities, enabling the participants to share their experiences and learn from each other. By focusing on women's empowerment, CSB-CMER&TI aimed to foster gender equality and encourage more women to take up leadership roles in the sericulture sector.



Workshop held at the institute on November 29, 2023



Workshop on Challenges and Opportunities in Muga and Eri Culture

Brainstorming Workshop on Challenges and Opportunities in Muga and Eri Culture

CSB-CMER&TI organized a brainstorming workshop on the "Challenges and Opportunities in Muga and Eri Culture" in Jorhat on March 12, 2024. This workshop brought together over 60 participants, including experts from various sericultural fields, scientists from the Central Silk Board (CSB), officers from the Department of Sericulture (DoS), university faculty members, and progressive farmers. The diverse mix of attendees facilitated a comprehensive and multifaceted discussion on the current state of muga and eri culture. Key topics included innovative farming techniques, pest and disease management, market expansion strategies, and policy recommendations to support the industry. Participants engaged in collaborative sessions to identify practical solutions to existing challenges and explore new opportunities for growth. The workshop's outcomes included actionable insights and strategic plans aimed at enhancing the productivity and sustainability of muga and eri sericulture.



EXTENSION COMMUNICATION PROGRAMS

In the year 2023-24, the Central Muga Eri Research & Training Institute (CMER&TI) and its nested units executed an extensive Extension Communication Programme, significantly contributing to the education and empowerment of farmers across the northeastern states of India. Beyond the notable Reshom Krishmela and specialized workshops, the institute organized a variety of targeted initiatives aimed at promoting advanced sericulture practices and technologies.

Farmers Field Day

A series of eight Farmers Field Days were conducted, providing practical, hands-on experiences for farmers. These events served as dynamic platforms for disseminating knowledge about modern sericulture techniques and best practices directly in the fields where the farmers work. The interactive nature of these field days allowed for real-time demonstrations and personalized guidance, enhancing the practical understanding of the participants.

Technology Awareness Programmes

To further extend the reach of sericulture advancements, CSB-CMER&TI implemented 30 Technology Awareness Programmes. These sessions were designed to raise awareness about the latest developments in muga and eri culture. Experts from the institute shared insights on innovative technologies, pest management strategies, and sustainable farming practices. The programmes were instrumental in bridging the knowledge gap and encouraging farmers to adopt new methodologies.

Technology Demonstration Programmes

Complementing the awareness initiatives, 30 Technology Demonstration Programmes were organized to showcase the practical application of sericulture technologies. These demonstrations provided a comprehensive overview of the processes involved in muga and eri culture, from cocoon production to silk harvesting. Farmers had the opportunity to observe and engage with the technology firsthand, fostering a deeper understanding and greater confidence in its implementation.

Farmer Participation and Outreach

Through these combined efforts, CSB-CMER&TI successfully educated and informed a total of 3,288 farmers across various regions in the northeastern states. The extensive outreach and active participation underscored the institute's commitment to improving the livelihoods of sericulture farmers through education and innovation.





Exhibitions and Technology Showcases

In addition to the organized programmes, CSB-CMER&TI also participated in numerous exhibitions arranged by different organizations. At these events, the institute showcased cutting-edge muga and eri culture technologies, attracting attention from a broader audience. These exhibitions provided an excellent platform for highlighting the institute's work and promoting the adoption of advanced sericulture techniques.

Programme	CSB-CMER&TI	RSRS, Boko	RSRS, Imphal	REC, Lakhimpur	REC, Fatehpur	REC, Coochbehar	REC, Sile
Farmers Field Day	07	01	-	-	-	-	-
Tech. awareness programme	08	05	02	05	03	03	04
Tech. demonstration	08	05	02	05	03	03	04
Total	23	11	04	10	06	06	08

Some photographs of various extension communication programmes are shown below



Farmers Field Day organized by CSB-CMER&TI, Lahdoigarh



Technology Awareness programme of CSB-CMER&TI, Lahdoigarh



Technology Awareness programme of RSRS, Boko



Technology Awareness of REC, Sile



Technology Awareness of REC, Fatehpur



Technology awareness programme of REC, Lakhimpur



Technology awareness programme of REC, Coochbehar



Technology Demonstration of CSB-CMER&TI



Technology Demonstration of REC, Lakhimpur



Technology Demonstration of REC, Fatehpur





Showcasing muga and eri culture technologies at various exhibitions





क्षमता निर्माण एवं प्रशिक्षण प्रभाग

**CAPACITY BUILDING &
TRAINING DIVISION**





**CAPACITY BUILDING AND TRAINING PROGRAMMES OF CMERTI
LAHDOIGARH FOR 2023-2024**

Particulars	Achievement (2023-24)		
	Physical (Nos.)	Beneficiaries (No.)	Financial (Rs.)
Structured Training Course*			
Farmers skill training	15	468	19.41
Technology Orientation Programme	8	257	9.32
Training under Post Cocoon Sector	5	157	4.88
Sericulture Resource Centres (SRCs)	48	960	2.88
Management Development Programme under STEP	1	50	0.80
Hands-on training on Chawki rearing	2	40	0
Other Need Based Training Programmes (New Scientist of CSB)	1	6	0
PGDS	1	5	0
Non-CBT: Training programme funded by agencies other than CSB*	3	60	0
Establishment of new SRCs	4	0	16.00
Total	88	2003	53.29





Few glimpses of capacity building and training programmes conducted by the institute







ONGOING- PROJECTS

Project Code : ARP 5023 CN
Project Title : Muga and Eri Silkworm disease monitoring and management in northeastern states of India.
Project Period : March 2023 to February 2028
Funding Agency : Central Silk Board, Bengaluru
Budget Allocation : Rs. 41.00 Lakhs
Scientists Involved : Bitupon Das., PI,
 Lopamudra Guha, Co-PI
 All Scientists of CSB-CMER&TI (CIs)
 All Scientists of MESSO units (CIs).

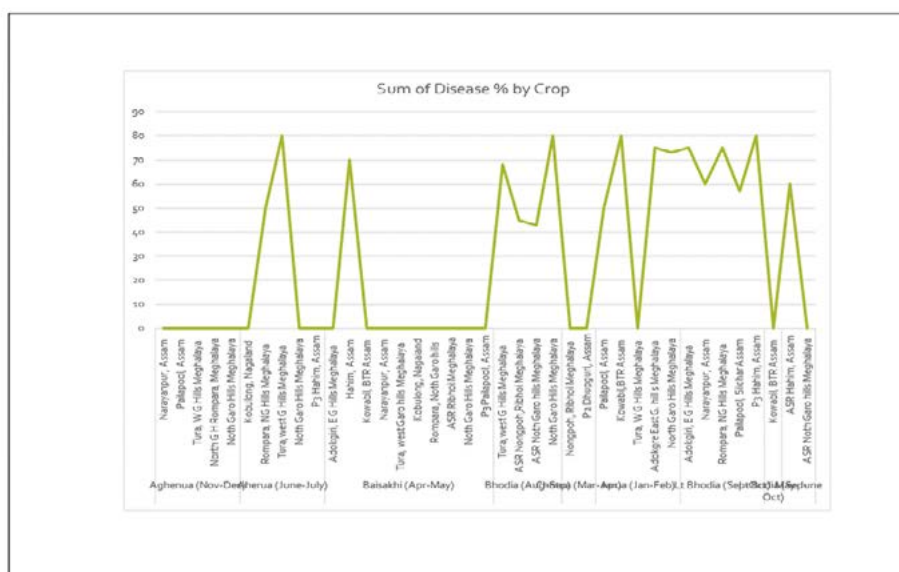
Objectives : 1. To monitor silkworm diseases during grainage and rearing and its management with respective DoS in North eastern states.

Summary of the findings/achievements:

Activities conducted

- Conducted training for Scientists of CSB-MESSO & CSB-CMER&TI, and their nested units.
- Provided training for all nominated State officers.
- Developed Google Sheets for the submission of monitoring reports.
- Prepared and distributed a Manual of Disease Monitoring to all Chief Inspectors (CIs).
- Created a WhatsApp group for effective communication with DoS officers involved in the project.
- Established zone-wise monitoring groups, involving DoS officers, scientists, and coordinators for effective monitoring.

Monitoring Activities:





Crop-wise monitoring was conducted across various districts in Assam, Meghalaya, BTR, Nagaland, Arunachal Pradesh, and other locations, including ASRs and DOS farms. The monitoring team prescribed all necessary remedial measures for the containment of diseases to the farmers and agencies involved. Detailed reports were furnished, outlining crop-wise and location-wise findings and recommendations.

Monitoring at DoS level (Muga)

	Place/Unit	Crop	Disease %
1	Mahmora farm	Jarua	60 (Mus)_
2	Kachopathar Farm, Sivsagar	Jarua	Medium density Pebrine
3	P-2 Farm Bhakatpara	Late-Jarua	5% (Mus)
4	Govt. seed farm Assam	Jarua	0

Monitoring at ASR level (Eri)

	CROP	ASRS UNDER	DISEASE %
1	August	P-2 Topatoli	3.3 (Gr)
2	September	P-2 Topatoli	2.14 (gr)
3	October	P-2 Topatoli	0
4	Autumn	P-2 Topatoli	0
5	Autumn	P-2 Topatoli	0

Monitoring at DoS level (Eri)

	CROP	PLACE	DATE OF VISIT	DISEASE %
1	Autumn	DoS Farm	16-10-23	0
2	Autumn	DoS Farm	16-10-23	0
3	Autumn	DoS Farm	16-10-23	0
4	Autumn	DoS Farm	16-10-23	0
5	Autumn	DoS Farm	16-10-23	0
6	Autumn	DoS Farm	16-10-23	0
7	Winter	DoS Farm	3-11-23	0

Crop loss due to infectious Flacherie especially in Sept-October in the range of (60-80%) in Tura, Hahim, Silchar, and Narayanpur is a serious problem, In Aug-Sept incidence of Flacherie in Meghalaya (68-80%) is observed. In Jan-Feb Muscardine incidence (73-80%) was observed in Tura, Rompara and Meghalaya, no incidence of disease in Eri rearing was conducted in October at the DoS level.





अधीनस्थ इकाइयाँ की गतिविधियाँ

ACTIVITIES OF NESTED UNITS





REGIONAL SERICULTURAL RESEARCH STATION IMPHAL, MANIPUR

Over the past year, significant progress has been made in various research and operational activities at RSRS Imphal. Eight research projects, including two as Principal Investigator and six as Co-Investigator (with CSRTI Behrampore), are progressing according to milestones set by CSB and DBT. RSRS Imphal has successfully produced and distributed Oak tasar basic seeds to the Departments of Sericulture (DOSs) in Northeast states and farmers. The germplasm bank (GPB) for Oak Tasar maintains two species, *Antheraea proylei* and *A. pernyi*, and seven elite lines, alongside two exotic breeds, with notable yields including 48 cocoons per dfl in the C27 genotype. Additionally, primary food plants for various silkworm species are being maintained. Six Transfer of Technology (ToT) programs on Oak Tasar and Eri culture showed productivity improvements, and two farmer training programs were conducted. Maintenance efforts extend to wild silkworm *A. frithi* and thermo-tolerant lines of *A. proylei*, as well as Eri silkworm strains. Publications include a bilingual booklet on oak tasar disease management and a local language booklet on Eri culture practices. The unit achieved recognition with two 3rd best research paper awards at an international conference. Outreach under the ECP included awareness programs and technology demonstrations for 140 stakeholders. Financially, the sale of oak tasar dfl and pierced cocoons realized Rs. 2,26,203/- in revenue. Regular Hindi workshops, Hindi Pakhwada, and Swachhata activities were also organized to promote language use and cleanliness, respectively.

CONCLUDED PROJECTS:

Project Code	: AIB-05009-SI
Project Title	: Isolation of thermotolerant line (s) of oak tasar silkworm <i>Antheraea proylei</i> J.
Project Period	: October, 2019 to September, 2023
Funding Agency	: Central Silk Board, Bengaluru
Budget Allocation	: Rs. 21.90 Lakhs
Scientists Involved	: Y. Debaraj, RSRS, Imphal, PI S. Subharani, RSRS, Imphal, CI Arun Kumar KP, CSB-CMER&TI, CI
Objectives	: 1. To isolate thermo-tolerant line of oak tasar silkworm, <i>Antheraea proylei</i> 2. Characterization of Heat shock protein gene in thermo-tolerant line.

Summary of the findings/achievements :

- Three lines of oak Tasar silkworm viz., *A. proylei*, C-27 and RTRS-1 were selected for the study. The rearing was conducted in experimental field of Regional Sericultural Research Station, Imphal to assess the impact of heat stress on larval duration, larval





weight, effective rate of rearing (ERR), cocoon yield and cocoon economic traits during spring and autumn crop.

- The fifth instar third day larvae of all the three breeds viz., *A. proylei*, C-27, RTRS-1 were exposed at 38°C/6hr everyday till spinning in BOD incubator. Similar set of larvae were maintained at normal room temperature (25 °C) condition in the rearing house as control. After spinning, the cocoons were sorted. Mortality of the larvae were recorded separately in the treated sets and assessed in percentage. The cocoons were sorted and the seed cocoons formed by the treated larvae were considered as thermo-tolerant and larvae which could not spin cocoons properly and those which died at the larval stage itself are considered as thermo-susceptible.
 - Protein content of the haemolymph from the heat-treated larvae were estimated using standard BCA Protein assay. Equal amounts (10 ug) of proteins were separated in 12% SDS PAGE. After the separation of the protein bands, the gel was stained with Coomassie brilliant blue. Protein bands were observed in Gel doc system (BIO RAD).
1. The fifth instar oak tasar larvae of the three lines viz., *A. proylei*, C-27 and RTRS-1 on reaching 3rd day were subjected to heat stress for 6 hrs at different temperatures (32°C, 35°C and 38°C) till spinning and a separate lot was maintained at 25 °C as control. The different rearing parameters recorded were larval duration in days, cocoon parameters (Single cocoon weight in grams, Shell weight in grams, Shell ratio in %) and Effective Rate of Rearing (ERR %), Fecundity (%) and Hatchability (%) were calculated.
 2. *Antheraea proylei*, RTRS-1 and C-27 after inducing heat stress at different temperatures 32, 35, 38 °C in 5th instar larvae recorded decreased ERR % with increase in heat stress.
 3. Survival % of the heat-treated silkworms was comparatively low as compared with those of the control.
 4. Effect of heat stress on commercial traits of cocoons showed less cocoon weight over control population.
 5. The heat shock 5th instar larvae of three oak tasar breeds recorded decreased in survival % with increase in heat stress at different temperatures (32, 35, 38 °C).
 6. Effect of heat stress on the larvae of three oak tasar breeds revealed that C-27 is more tolerant at 38 °C based on the survival (%).
 7. Cocoon characters in all the breeds after heat shock showed improvement over control upto 35 °C and decreased at 38 °C.
 8. Protein profiling studies revealed -
 - a. -significant expression of 60 kDa protein only at 38 °C in *A. proylei*
 - b. -maximum expression of 60 kDa and 48 kDa protein at 38 °C in C-27
 - c. -significant expression of 47 kDa and 30 kDa protein at 38 °C in RTRS-1
 Expression of five major HSPs, viz., 19.9, 21, 60, 70, 90 were observed in fifth instar larvae upon heat shock in different breeds.





9. RAPD marker revealed significant DNA polymorphism among thermo-susceptible and thermo-tolerant lines of *Antheraea proylei*.
10. The thermotolerant line C-27 breed which is more survival (%) at higher temperature can be popularized at farmers' level to enhance productivity of oak tasar silk. The breed will be validated through On Station Trials (OST).

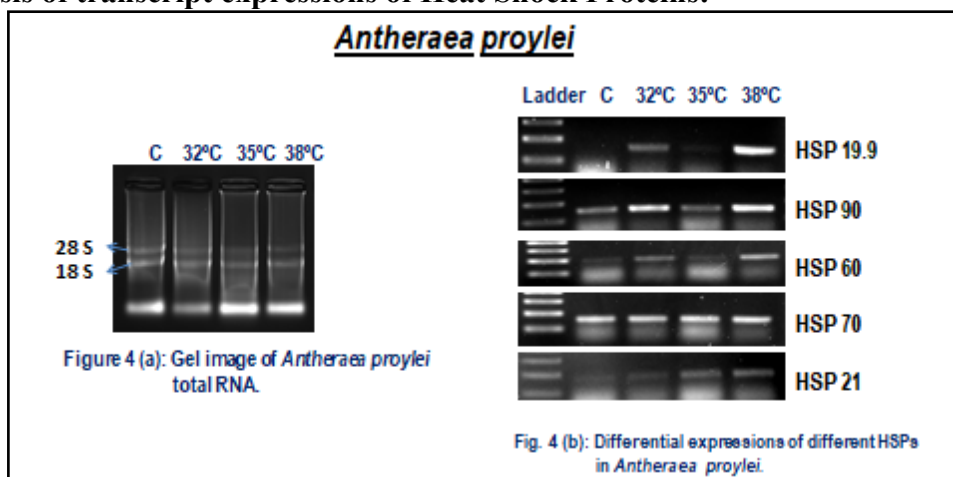
Table: Effect of thermal stress on survival of different breeds of oak tasar silkworms

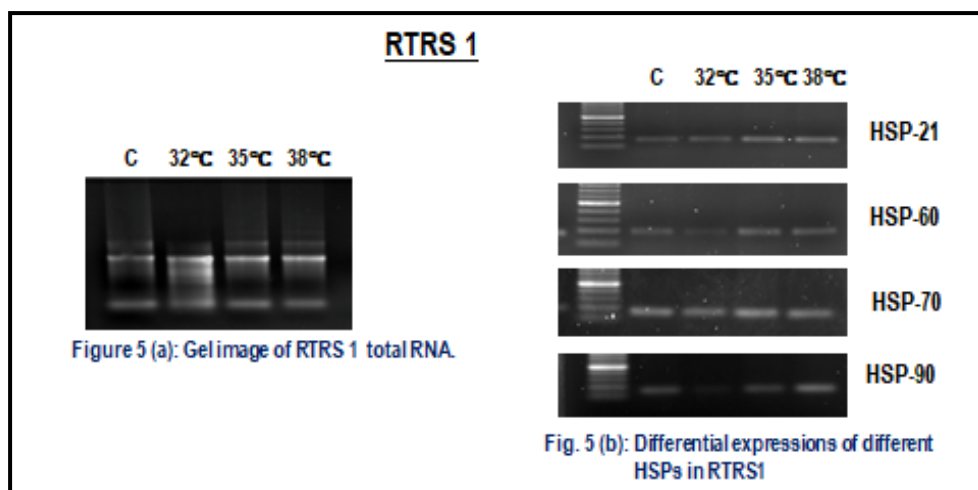
Duration of temperature exposure (from 3 rd day 5 th instar larvae till spinning) 6 hrs	Temperatures (°C)	Survival (%)		
		<i>Antheraea proylei</i>	C-27	RTRS-1
	25	40.25	41.75	37.25
	32	39.50	40.00	35.50
	35	35.00	37.75	35.25
	38	16.50	24.75	16.25
	SEM	0.80	0.45	0.87
	CD at 5%	2.59	1.45	2.82



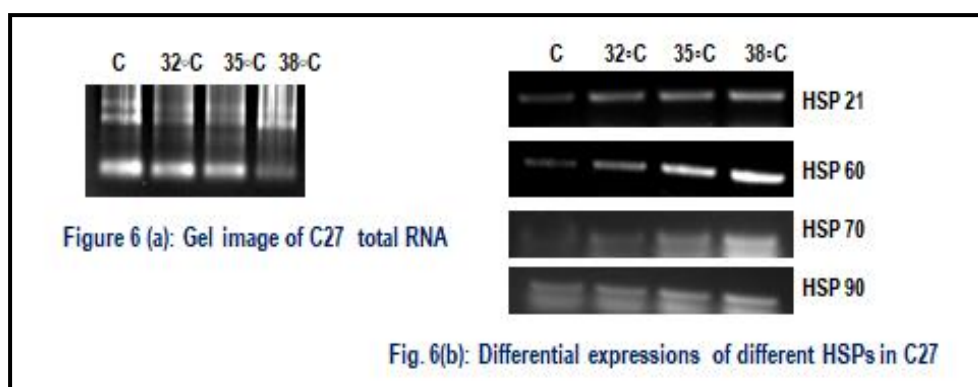
Fig. Outdoor rearing after induction of heat stress and RNA isolation of haemolymph from heat induced larvae

Analysis of transcript expressions of Heat Shock Proteins:





C27



ONGOING PROJECTS:

Project Code: APS-05021-EF

Project Title: Studies on population diversity and role of host plant volatile cues for enhancing egg laying in temperate tasar (Vanya) silk moths *Antheraea proylei*.

Project Period	: Jan 2022- Dec, 2024
Funding Agency	: Central Silk Board
Total Budget allocation	: Rs. 122.48 lakhs
Scientists involved	: S. Subharani Devi, RSRS, Imphal, PI Y. Debaraj, RSRS, Imphal, CI K M Vijayakumari, CMERTI Lahdoigarh

Objectives:

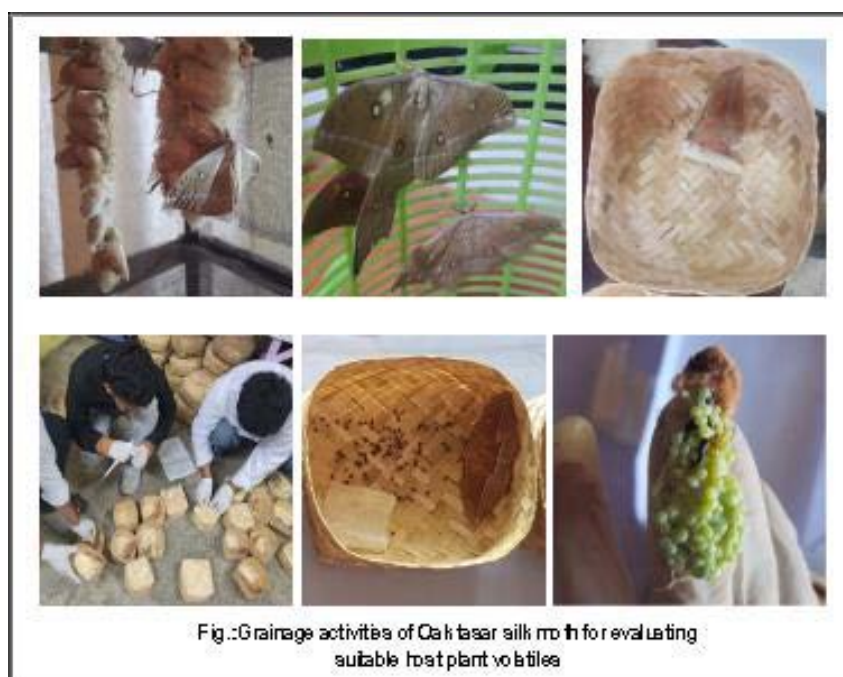
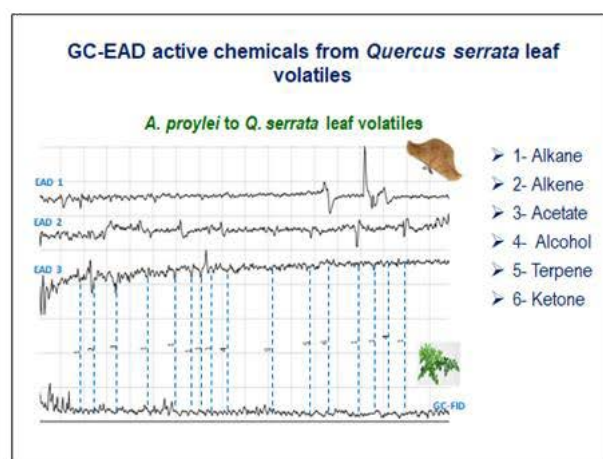
1. To survey and establish population diversity of Oak tasar silk moths across NER.
2. To establish potent food plants (Host) for Oak tasar silk moths, *A. proylei* for egg production.
3. To isolate and evaluate highly suitable host plant volatiles to activate/ increase egg laying in Oak tasar silk moth.
4. To standardize the synthetic oviposition stimulant blends to enhance egg production in Oak tasar silk moths and establishing the efficacy of developed technology.
5. To evaluate the synthetic volatile blend in large scale at Oak tasar Seed production centers.





Summary of the findings/achievements:

- Surveyed and collected oak tasar silk moth, *Antheraea frithi* cocoons from different districts of Manipur Thoubal, Churachanpur, Imphal East, Senapati, Kangpokpi and Bishnupur in the host plant *Lithocarpus dealbata*.
- The host plants viz. *Quercus serrata*, *Q. dealbata*, *Q. griffithii*, *Q. semicarpifolia* and *Q. incana* leaves and stems recorded higher percentage of realized eggs than untreated control.
- Chemical cues that are responsible for stimulating *A. proylei* moth egg laying was identified and confirmed through Gas chromatography–electroantennographic detection (GC-EAD) and Gas chromatography – mass spectroscopy (GC-MS) from host plants leaves and stems volatiles.
- Totally 58 responsible chemicals were identified which are stimulating response to *A. proylei* antennae. Out of which 17 individual chemicals of 100 ppm concentration were tested to know egg laying capacity of tasar silk moth.





Project Code: SPR 05028 SIC

Project Title: Popularization of improved technologies of Muga Culture for enhancing cocoon production in Manipur.

Project Period	: February 2024 to January 2026
Funding Agency	: Central Silk Board
Total Budget allocation	: Rs. 13.20 lakhs
Scientists involved	: Kh, Subadas Singh RSRS, Imphal, PI L. Somen Singh, RSRS, Imphal, CI

Summary of the findings/achievements:

- Selection of muga farmers has been completed in Imphal East District of Manipur in coordination with State Sericulture Department, Manipur.
- Benchmark survey of the selected farmers has been completed. Sensitization programme for Muga farmers has been performed.



Outreach programs



Farmers Awareness Programme on Muga and Eri culture at Koirengei Bazar, Imphal East (04.09.2023)



Farmers Awareness Programme on Muga and Ericulture at Wangdei Meitei Leikai, Langol village, Imphal West (12.09.2023)



Technology Demonstration Program at Koirengei Bazar, Imphal East (04.09.2023) and Wangdei Meitei Leikai, Langol village, Imphal West (12.09.2023)

Capacity Building and Training



Farmers' skill training program on silkworm rearing and post-cocoon technology aspects for 25 beneficiaries conducted from December 11–15th 2023, at Samurou Bazar, Imphal West



REGIONAL SERICULTURE RESEARCH STATION (RSRS), BOKO, ASSAM

Highlights of activities/achievements

- 5000 Kesseru Seedlings were raised and 3000 seedlings were supplied. A total of 260 som seedlings were supplied.
- Under the extension and Communication Programme, 785 farmers were covered through Krishimela, Awareness Programmes, Field Days, and Technology Demonstration Programme.
- Under Human Resource Development, 3 batches of farmer's skill Training, 4 batches of Technology Orientation Programme and 3 batches of Post Cocoon Training Programme were conducted and 280 framers/students were trained.
- Under commercial Muga crop rearing 750 g DFLs were reared produced 42,133 Nos. of commercial cocoons.
- The centre generated a total revenue of Rs.2,07,738.00

Capacity Building and Training Institute-wise for financial year of 2021-2022						
#	Name of the Trng. Programme	Target for the Year		Progress till the end of the year		
		Physical	Financial	Physical	Financial	No of farmers/Students trained
1	Exposure visit for Technology Awareness	-	-	-	-	
2	Farmers' Skill Training	4	4.50	3	3.375	75
3	Technology Orientation Programme (Officials from DoS& CSB)	3	2.85	4	4.31	115
4	Training under the Post-cocoon sector	2	1.80	3	3.18	90
5	Training under Sericulture Resource Centre	-	-	-	-	
6	Training under STEP by the Institute	-	-	-	-	
	Sub Total	9	9.15	10	10.865	280
7	Training funded under - NON-CBT	-	-	-	-	
8	Training funded under - NON CSB	-	-	-	-	
	Sub Total	0	0	0	0	
	Grand Total	9	9.15	10	10.865	280

Year		Temperature (°C)		Rel. Humidity %		Nos. of rainy Days	Rainfall (mm)
	Month	Max.	Min.	Max.	Min.		
	April	37	19	98	50.7	10	135
	May	37	20	99	59.5	13	299
	June	38	23	99	56.5	23	490



2022	July	38	25	64	98.5	18	272
	August	37	24	98.5	60.2	16	184
	September	37	23	98.5	62.5	13	95
	October	34	21	98	58	11	170
	November	33	17	98	55	0	0.00
	December	29	10	97	45.5	0	0.00
2023	January	28	11	97	55	0	0.00
	February	30	10	96	43.7	0	0.00
	March	33	13	97	47	5	70

Extension activities

Particulars	Target	Achievement
Supply of Som/Soalu planting materials (Nos.)	-	260
Commercial	2500	750
Commercial	1500000	42,133

Extension Communication Programme:

Particulars	Target	Achievement
Krishi Mela	1	1 (250)
Field Day	1	1 (78)
Technology Awareness programme	4	5(302)
Technology Demonstration	4	5 (155)

Nursery	Plantation area	National Bamboo Mission	Low land	Roads	Office Building and Laboratory	Staff Quarters	Total	Vacant	Status of land
2.50	24.50	2.00	1.50	6.50	7.00	6.00	50	Nil	Own land

Total acre of plantation: 24.5 acre plantation of Som and Soalu

Available host plant: 10,044 plants

Four quarterly Hindi Meetings along with 4 Hindi workshops were organized. A total of 80 Officers/Officials took part in the above programme. Hindi Diwas on 14.09.23 and Hindi week w.e.f 08.09.2023 to 14.09.2023 were also organized.

Staff details, transfer, newly joined, retired officials etc.:

Sl No	Designation	No
1	Scientist-D	1
2	Scientist-C	Nil
3	STA	1
4	Sr.FA	2
4	AT	Nil
5	MTS	2





ERI RESEARCH EXTENTION CENTRE (EREC), FATEHPUR, UTTAR PRADESH

Introduction

The Eri Research Extension Centre, Fatehpur (U.P.) situated at Fatehpur District of U.P. was started in May 2006 in a rented building at Auraiya (U.P.) under CSB-CMER&TI, Lahdoigarh (Assam) with the objective of providing extension support to State DoS, U.P. and the N.G.O. namely Sharmik Bharati Kanpur (U.P.) for the cause of Ericulture development in non-traditional State of U.P. It was working over there till December 2009. Thereafter shifted to Fatehpur district (U.P.) in January 2010 in compliance with the decision of the Competent Authority by establishing an Office in a Private (rented) building with the objective to cater the need of Technological support and monitoring to castor growers for Ericulture through DoS (U.P.)

As per mandate and target allotted by the main Institute CSB-CMER&TI, Lahdoigarh (Assam), the following Technical activities have been performed by the Centre during the Year (2023-24) under-report in Association with District DoS, U.P. for the growth of Ericulture in Non-Traditional State U.P. with special reference to District Fatehpur, Kanpur Nagar, Kanpur Dehat, Unnao, Hamirpur, Chitrakoot, Jalon and Banda through Extension activities, Technology Awareness Meet, Field Day, Group Discussion, Training, Technology Demonstration, Supervision and Monitoring of Eri rearing and grainage and other activities under Transfer of Technology etc.

Highlights of activities/achievements

- EREC, Fatehpur (U.P.) has done a commendable job in U.P., Bihar and Gujarat this year.
- EREC, Fatehpur (U.P.) imparted quality training (6 Batch, 160 Farmers) to Eri Farmers and Trained 160 Eri farmers and achieved a 160% target against 100 Nos of Farmers.
- EREC, Fatehpur (U.P.) imparted quality training (3 Batch, 81 Students and NGO Official) to Students and NGOs.
- EREC, Fatehpur (U.P.) Organized 04 Technology Awareness Meet Programme and 04 Technology Demonstration Programme organized in Uttar Pradesh (01.07.2023, 14.07.2023, 30.10.2023 & 09.01.2024)
- EREC, Fatehpur (U.P.) imparted quality training to Eri Farmers of DoS (U.P.) in Mirzapur (U.P.) (130 Farmers).
- EREC, Fatehpur (U.P.) received 1st prize from the Director, CSB-CMER&TI, Lahadoigarh (Assam) and 3rd prize from न०रा०क०स०, फतेहपुर (उ०प्र०) for best performance of Official Language during the 2023-24.





- Suraj Pal, Scientist-D visited Gujarat (June 2023) for the popularization of Eri culture in Gujarat.
- Meteorological Data of EREC, Fatehpur (U.P.) have been recorded for the year 2023-24.

Capacity Building & Training Programmes

Sl. No.	Type of Training	No. of batches	No. of Farmers Trained	Financially
1.	Farmer Skill Training	06	160 (106%)	716,000.00
2.	Technology Orientation Programme	03	81 (108%)	285,000.00
TOTAL		09	241 (107%)	1,001,000.00

Extension Communication Programmes

S L	ACTIVITIES	Target		Achievement		No. of Farmers	
		Physically	Financially	Physically	Financially	Target	Achievement
1.	Technology Awareness Meet	04	40000.00	04	40000.00	250	290 (116%)
2.	Technology Demonstration	04	4000.00	04	4000.00	100	290 (116%)
	TOTAL	08	44000.00	04	44000.00	350	580 (165%)

Training organized by DoS, Uttar Pradesh & Bihar:

- During the year 2023-24, Shri Suraj Pal, Scientist-D and Shri Deen Mohamad, STA, EREC, Fatehpur imparted quality Training to Eri Farmer at Mirzapur (U.P.) in November 2023 & February 2024 and covered 130 Eri farmers.
- During the year 2023-24 Shri Suraj Pal, Scientist-D EREC, Fatehpur imparted quality Training to DoS, U.P. Official at Mirzapur (U.P.) in February 2024 under TOP Programme organized by REC, CSB, Basti (U.P.).

Other Technical Activities:

- Conducted survey and surveillance of disease and insect pest occurrence in castor plantation and Eri Silkworm.

Vigilance Awareness Week: (16 August 2023 to 15 November 2023)





- REC, Fatehpur has organized 01 Vigilance Awareness Week from 16 August 2023 to 15 November 2023. Under this event, the Centre has organized 03 programs in the office campus on 18.09.2023, 20.10.2023 and 15.11.2023. A total of 71 CSB Officers/Officials, DoS Officials and Eri Farmers participated in this program.

Swachchhta Hi Seva: (from 01.10.2023 to 31.10.2023)

- A total of 55 CSB Officers/Officials and DoS Officials have participated in this program from 01.10.2023 to 31.10.2023.

Swachchhta Pakhwada: (from 01.03.2024 to 15.03.2024)

- This centre has been organized Swachchhta Pakhwada (01.03.2024 to 15.03.2024). During the program, an awareness campaign was organized at Railway Station, Govt. Hospital, Govt. Bus Stand and Govt. School and distributed pamphlets in the Fatehpur district. During the programme EREC, Fatehpur has conducted a cleanliness drive at the Office campus and maintained old files, registers and Official documents.

Implementation of Official Language (Rajbhasa Hindi):

- EREC, CSB, Fatehpur (U.P.) has received 3rd Prize from न०रा०का०स०, फतेहपुर (उ०प्र०) for best performance of Official Language during the year 2023-24.

Details of Human Resource

SL	Name	Designation	w.e.f.
1	Sri. Suraj Pal	Scientist – D	01.08.2016
2.	Shri Deen Mohammad	Senior Technical Assistant	09.07.2021
	Shri Raj Narayan	Field Assistant	13.07.2021
2	Sri. Ramjiwan	Field Assistant	13.08.2018
3	Sri. Suresh	Assistant Technician	01.04.2017
4	Sri Jokhu Ram	MTS	01.01.2021

Meteorological Data:

Month & Year	Average Temperature (°C)		Average Relative Humidity (%)		Nos. of Rainy Days	Avg. Rainfall (mm)
	Mani.	Maxi.	Mani.	Maxi.		
Apr, 2023	42	25	89	50	04	2.75
May, 2023	42	30	63	29	06	4.16
June, 2023	43	32	82	52	05	15.20



July, 2023	38	29	85	58	11	14.36
Aug, 2023	36	29	92	83	04	15.25
Sept, 2023	37	27	91	68	08	14.87
Oct, 2023	37	28	86	52	02	20
Nov, 2023	33	20	57	34	-	-
Dec, 2023	29	18	90	48	02	05
Jan, 2024	21	13	90	45	-	-
Feb, 2024	31	16	93	50	-	-
Mar, 2024	38	23	85	40	02	4.5

Photographs of activities





Technology Awareness meets conducted during the year 2023-24





Farmer Skill Training Programme at EREC, Fatehpur



Technology Orientation Programme at EREC, Fatehpur



Visited Sericulture resource centres in Gujarat



Celebrated Swachhta Pakhwada





Celebrated Swachhta Hi Seva

Attended meeting and received prize from नराकास०, फतेहपुर (उ०प्र०)



IMPORTANT EVENTS AND OVERALL ACTIVITIES OF THE INSTITUTE





Research Extension Centre (REC) Visit

On April 19 to 20, 2023, Dr. K.M. Vijaya Kumari, Director of CSB-CMER&TI, along with Dr. D. Mech, Scientist-D from the SEEM Division of the Institute, visited REC Lakhimpur in Assam, and REC Sille in Arunachal Pradesh. Dr. K.M. Vijaya Kumari, actively monitored various activities within the units, reviewing progress, identifying constraints, and offering suggestions for improvement. Emphasizing regular visits to farmers' fields to provide technical guidance, she aimed to ensure successful crop outcomes. Her inspection extended to farmers' fields and interactions with entrepreneurs in both Lakhimpur and Sille, where she, along with the respective Department of Sericulture (DoS) officers, observed ongoing activities. Dr. K.M. Vijaya Kumari engaged with farmers and entrepreneurs, providing valuable guidance for enhancing product quality and income generation.



Silkworm Seed Production Centre (SSPC) Visit

On April 25, 2023, Dr. K.M. Vijay Kumari, Director of CSB-CMER&TI, Lahdoigarh, paid a visit to SSPC Jorhat and gave the technical guidance it needed to continue the commercial grainage operations for the autumn harvest.





Onsite training and Demonstration of Eri chawki rearing technology

From April 23 to May 2, an on-site demonstration and popularization of the newly developed Eri Chawki Rearing Technology by CSB-CMER&TI, Lahdoigarh, was conducted at the State Sericulture Farm in Dhansiripar (Chumoukedima district), Nagaland. The event was organized in collaboration with the Department of Sericulture (DoS), Dimapur, Nagaland. Dr. Mahesh DS, Scientist-C, along with his team, showcased the entire Eri Chawki rearing process. Twenty committed farmers and DoS staff from Dhansiripar actively engaged in this week-long program, aimed at raising awareness and encouraging the adoption of this technology. Concluding the demonstration, Dr. K.M. Vijaya Kumari, Director of CSB-CMER&TI, Lahdoigarh, addressed the assembled farmers and DoS officers. She underscored the importance and advantages of Chawki Rearing Technology and distributed Eri Chawki worms (during the second moult) to the participating farmers.

Local Advisory Committee (LAC) Meeting

The 83 meeting of the Local Advisory Committee convened at MESSO, Guwahati, with the primary agenda of determining grade-by-grade floor prices for Muga and Eri silk commodities. Chaired by Dr. Kartik Neog, Director of MESSO, and Sri. Ataur Rahman, Additional Director, Govt. of Assam, the meeting included representatives from the Department of Sericulture (DoS), CSB scientists from NER, and farmer members/representatives from the Muga and Eri sector.



Exposure Visit of Agricultural Students at CSB-CMER&TI, Lahdoigarh

On May 17, 2023, a group of B.Sc. (Agri) students from Assam Agricultural University, Jorhat, visited the CSB-CMER&TI campus with the aim of gaining insights into Muga and Eri culture. During their visit, the students explored various laboratories and farms, engaging with scientists from different disciplines. The scientists showcased different technologies and ongoing farm activities, providing valuable exposure to the intricacies of Muga and Eri culture.





The CSB-CMER&TI team also paid a visit to the government mulberry seed farm at Thenzawlalong with Dr. Rahama Thulaq Scientist D from Central Office, Bengaluru, RO, Guwahati, PMC Guwahati, and DOS, Mizoram. At the station, 400 DFL Muga silkworms were being raised. The team also travelled to other villages of Chhiahtlang and Baktawng in Serchhip District to observe the advancements made by the recipients of Eri culture adopted under Silk Samagra-2. On May 25, 2023, Dr. K.M. Vijaya Kumari, Director of CSB-CMER&TI Lahdoigarh, attended the closing ceremony of the NERTPS workshop and the workshop on Silk Samagra-2 at Aizawl. On May 26, 2023, the Mizoram State Project Monitoring Committee had a meeting, and on May 27, 2023, a field visit was conducted with farmers who had been adopted under Silk Samagra-2



Training on Muga and Eri Silkworm Disease Monitoring System

CSB-CMER&TI, Lahdoigarh conducted a day-long training program on the Muga and Eri Silkworm Disease Monitoring system for the Scientists of CSB and DoS officers under the ongoing Muga and Eri Silkworm Disease Monitoring project on 01.06.2023 at MESSO Guwahati. Shri Bitupon Das, Scientist-D & PI of the project presented details of the monitoring system of diseases, including the occurrence of seasonal diseases, diagnosis of diseases, preventive measures, etc.



World environment day



CSB-CMER&TI celebrated World Environment Day on June 5 with a commitment to environmental conservation. The day included a lifestyle pledge, Plantation drive, drawing competition and environmental quiz. CSB-CMER&TI remains dedicated to protecting the environment and creating a sustainable future.



International Day of Yoga

On June 21, 2023, In pursuit of 'One Earth, One Family, & One Future,' under the theme 'Yoga for Vasudhaiva Kutumbakam,' CSB-CMER&TI, Jorhat is dedicated to fostering awareness of yoga for the holistic unity of our nation.



Bodoland Sericulture Mission

The Bodoland Sericulture Mission was officially launched, marked by a momentous Memorandum of Understanding (MOU) signing ceremony at the Bodo Cultural Complex. This comprehensive convergence project aims to enhance incomes and stimulate sericulture development in the Bodoland territorial region symbolizing a collective effort to empower the region's 40,000 silkworm rearers and 10,000 weavers. Esteemed dignitaries graced the occasion, including Shri Pramod Boro, Hon'ble Chief Executive Member of BTR; Sh. U.G. Brahma, Hon'ble Minister of Handloom & Textiles, Govt of Assam; and the director, CSB-CMER&TI, Lahdoigarh, Dr. K.M. Vijaya Kumari, represented MS, CSB (Ministry of Textiles, Govt. of India) signed the MOU. The event also saw the participation of the Principal Secretary, BTC; Assam Gaurav, Dr. Jogesh Deuri; Dr. Kartik Neog, Director MESSO; and various other notable figures from CSB, NEHHDC, and APART. The enthusiastic presence of over 2000 farmers, underscored the profound impact of the mission representing a journey toward transformation, prosperity, and unity.



National Handloom Day





A Grand Event with the Hon'ble Prime Minister Shri Narendra Modi as the Chief Guest and 50 Farmers from Northeast India witnessed the occasion at New Delhi on 7th August 2023. Alongside, Dr. K.M. Vijaya Kumari, the Director of the CSB-CMER&TI, Lahdoigarh, in attendance, were the M.S. of the CSB, Directors of CSB Institutes, and an array of distinguished guests from the Central Silk Board as they collectively honour the rich heritage of handlooms.

CSB-CMER&TI, Lahdoigarh Celebrated India's 76 years of Independence with "Har Ghar Tiranga" and "Meri Maati Mera Desh" Programs

In a spirit of unity and national pride, CSB-CMER&TI, Lahdoigarh celebrated India's 76 years of Independence. On this same day, CSB-CMER&TI, Lahdoigarh also organized the "Har Ghar Tiranga" and "Meri Maati Mera Desh" programs. "Har Ghar Tiranga" aimed to encourage every household to proudly display the national flag, while "Meri Maati Mera Desh" celebrated the rich cultural heritage of India and its diverse landscapes.



Visits

On 18 August 2023, Dr. K. Sathyanarayana, Assoc. Dean cum Principal of Kalam Agricultural College, Kishanganj, and Retired Director of CTR&TI, Ranchi, visited CSB-CMER&TI, Lahdoigarh. The primary focus of the discussions revolved around exploring potential collaborations for the dissemination of technologies developed in the field of Vanya sericulture.





On 19 August 2023, CSB-CMER&TI, Lahdoigarh organized a remarkable Sadbhavna Diwas event, promoting goodwill, unity, and harmony among its employees, led by Director Dr. K.M. Vijaya Kumari. Notably, Dr. K. Sathyanaraya, Assoc. Dean cum Principal of Kalam Agricultural College, Kishanganj, graced the occasion, standing in solidarity with the noble cause.



Overcoming Assam's Unfavourable Summers for Muga Silk

A transforming journey was set out with the steadfast goal of improving Muga seed availability (in Oct-Nov) and defeating unfavourable summer conditions in Assam. Beyond customary limits, the CSB-CMER&TI, Lahdoigarh, Silkworm Division is



performing raising in cooler climates/regions including Odisha, Andhra Pradesh, Arunachal Pradesh, and Mizoram. This was an initiative to reduce uncertainty in seed production during the hot summers and guarantee the supply of premium seed in traditional Muga rearing zones by utilizing the potential of cooler regions outside of the traditional locations. This is simply one of CSB-CMER&TI's many strategic efforts to support the continued growth of Muga silk production in India!

Silk Day

CSB-CMER&TI Lahdoigarh filled with delight on September 20, 2023, as Silk Day was observed with an array of interesting events. An interactive gathering of Upper Assam stakeholders, including thirty-two enthusiastic and youthful graduate students from the University of Agriculture Sciences, Chintamani, was held to kick off the celebrations. To take the Silk Day commitment, scientists, officials, and excited guests convened together.





Outstanding Recognition

During the year 2022-23, the Nagar Raj bhasha Karyanvayan Samiti (City Official Language Implementation Committee), Jorhat, Assam, honored M.A.A.P.S., Lahdoigarh, with the first award for their remarkable implementation of Hindi as the official language. This prestigious recognition remains a testament to the exemplary efforts in promoting Hindi as the official language.



Swachhata Abhiyan



On October 1, 2023, the whole staff of CSB-CMER&TI, Lahdoigarh, and its nested units, led by Director Dr. K.M. Vijaya Kumari, took a major step in the direction of a cleaner and greener future. Initiatives to promote cleanliness were launched in several locations, including Moinaporia Namghar in Lahdoigarh.

Gandhi Jayanti Celebration

CSB-CMER&TI commemorated Gandhi Jayanti on October 2nd, 2023, in remembrance of the Mahatma's enduring legacy of equality, nonviolence, and peace. His lessons continue to inspire in bringing about the change we desire in the world.



Meetings & Visits

The 42nd RAC meeting was held at CSB-CMER&TI, Lahdoigarh under the able chairmanship of Dr. Bidyut C. Deka, Hon'ble Vice Chancellor of AAU, (Assam Agricultural University), Jorhat and convened by Dr. K. M. Vijaya Kumari, Director of CSB-CMER&TI, Lahdoigarh on October 10, 2023. The dedicated members, including Prof. L.K. Hazarika, Retd. Professor & Head of Entomology, AAU; Dr. B.K. Singh, Retired Director (CSB-CMER&TI, Lahdoigarh); Prof. P K Neog,





Director EEI, AAU Guwahati; Directors of Sericulture from Nagaland and BTC as well as Additional Director and Deputy Director of Sericulture from Assam and Joint Director of Sericulture from Mizoram; Scientists from CO, CSB Bangalore besides rearers and reelers representatives also attended the meeting.

Dr. K.M. Vijaya Kumari, Director of CSB-CMER&TI, Lahdoigarh, attended the State Level Sericulture Coordination Committee and Project Monitoring Committee Meetings held at Aizawl, Mizoram on October 2, 2023. The progress of various projects under Silk Samagra-1 and 2 was reviewed. Technological assistance to help Mizoram's Vanya sericulture industry flourish was ensured by the CSB-CMER&TI, Lahdoigarh's team, and based on the favourable climate, recommended the enormous potential to develop the muga seed hub.



A notable interaction between the CSB-CMER&TI scientists and Dr. Nitin Kulkarni, Director of RFRI Jorhat was carried out on 13 October 2023. Their discussions revolved around ongoing research projects and their promising prospects igniting the spark of research collaboration and further uplifting the Vanya Sector in Northeastern India.



Member Secretary, CSB, Ministry of Textiles, Shri. P Sivakumar accompanied by Director, CSB-CMER&TI, Lahdoigarh, Dr. K M Vijayakumari and all other Directors from different CSB institutes paid a visit to the P2 Eri Basic Seed Farm in Topatoli on 09.11.2023. Presently, CSB-CMER&TI is actively involved in a collaborative project and Transfer of

Technology activities with this unit.

On November 24, 2023, Dr. N Krishna Kumar, Former DDG-ICAR and Member of RCC at the CSB paid a visit to CSB-CMER&TI, Lahdoigarh. He interacted with the Scientists of the Institute and reviewed the research activities of the CSB-CMERTI.





Vigilance Awareness Programmes

In line with a commitment to Vigilance Awareness Day, on October 30, 2023, Dr. K.M. Vijaya Kumari, Director of CMER&TI, Lahdoigarh, and all the Scientists/officers/officials of the Institute unitedly pledged the vigilance awareness ceremony.



On October 31, the CSB-CMER&TI, Lahdoigarh observed Rashtriya Ekta Divas, or National Unity Day, in honour of Sardar Vallabhbhai Patel, who was instrumental in bringing India together. The celebration included a pledge to reaffirm the nation's commitment to unity, integrity, and security.



On November 18, 2023, the Janajatiya Gourav Diwas was celebrated in Borhola, Jorhat. As part of the festivities, efforts were made to raise awareness about Eri culture among 37 tribal women participants. The program included gifting progressive Eri farmers to support and encourage the growth of Eri silk farming in the region, promoting cultural heritage and community development.

Technology Orientation, Demonstration Program & Trainings

From October 30, 2023, to November 3, 2023, the Training Division of CSB-CMER&TI, Lahdoigarh, held a technological orientation program at Swahid Peoli Phukan (SSP) College, Namti, Sivsagar. A total of five days of training were attended by 57 undergraduate students. Distinguished guests graced the inauguration function, including Dr. D J Nath, Principal of SPP College, and Dr. S Zaman Ahmed, Associate Professor and Senior Scientists from CSB-CMER&TI, Lahdoigarh. The presence of Dr. K. M. Vijaya Kumari, Director of CSB-CMER&TI, Lahdoigarh, who gave the event's opening speech, elevated the inauguration ceremony. The orientation program can be an invaluable resource, availing access to the newest innovations in Muga & Eri culture as a means of technology breakthroughs.



The Training Division of CSB-CMER&TI, Lahdoigarh, and Borholla Seri Model Village (PCT) collaborated to arrange a 5-day training session on Muga and Eri Post Cocoon Technology, which was scheduled on November 14, 2023. A total of 35 women from Borholla have actively engaged in the training. Dr. K.M. Vijayakumari, Director, gave an introductory speech to kick off the program.



The Muga culture's raising fields were the subject of a technology demonstration program run by the Extension Division of CSB-CMER&TI, Lahdoigarh. The event took place at Doba Muga VGR Farm, Chariedeo, on November 16, 2023. The main aim of the initiative was to provide Muga farmers with education and training on efficient disinfection methods to improve the general well-being and output of Muga silkworms. Twenty Muga farmers who were actively involved in Muga culture took part in the program. Their participation emphasizes how important the project is to the Muga farming community. Leading the demonstration was Dr. Vijay N, Scientist-C, who shared insightful information about how to disinfect appliances and rearing fields both before and after the rearing process.



The Technology Orientation Programme at EREC Fatehpur, Uttar Pradesh, was held from December 11 to December 15. The training includes comprehensive coverage of various technological aspects of Eri Culture to a group of 27 trainees.



A Skill Training Programme at REC Lakhimpur, Assam, focusing on "Muga Silkworm Rearing and its Host Plant Management" was held. The training covers various aspects, from silkworm rearing techniques to efficient management of host plants, providing a total of 32 Muga farmers with comprehensive knowledge to enhance their productivity and income.

Mega Expo 2023

Dr. K.M. Vijaya Kumari, Director (CSB-CMER&TI), Lahdoigarh, cordially greeted Shri Sivakumar Periyasamy, IFS, Member Secretary & CEO, CSB, Ministry of Textiles, GOI, on November 5, 2023, and gave him a tour of the wonderful exhibits from CSB-CMER&TI, Lahdoigrh regarding the Muga & Eri sericulture activities in Lucknow. The show was graced by the presence of Shri Sunil Kumar



Verma, IAS, Special Secretary & Director, Sericulture Development, U.P., who commended CSB, particularly EREC, Fatehpur, for their help in developing Eri culture in Uttar Pradesh. This fascinating trip to the Expo also included visits from Dr. N.B. Chaudhary, Director of CTR&TI, Ranchi (Tasar Vanya), T. Selvakumar, Director of BTSSO, CSB, Bilaspur, and N.K. Bhatia, Director of CSRTI, Pampore. The State Silk Farm and reeling unit in Gajaptipur and Kalpipara, in the Bahraich district of Uttar Pradesh, were subsequently visited by the Member Secretary of the Central Silk Board. He had conversations with various groups of farmers, reelers, FPOs, and state officials about the necessary measures to enhance the state's production of silk.





RCC Meeting and Books release

- 1) Spinning Gold - The success stories of Vanya cultivators by CSB-CMER&TI, Lahdoigarh
- 2) Muga silkworm host plant & rearing management by MESSO
- 3) Challenges to triumph: Success stories of muga & eri culture by MESSO Nongpoh



Samagra-2 scheme review meeting

A review meeting on the progress of the Silk Samagra-2 scheme and other sericulture initiatives was held at MESSO, Guwahati on November 10, 2023. Director Dr. K.M. Vijayakumari, CSB-CMER&TI, Lahdoigarh, and all other Directors of CSB institutes along with the officials from regional offices attended this meeting and provided valuable insights towards the successful implementation of the scheme. This meeting was graced by the presence of our esteemed Member Secretary, Shri. P. Sivakumar.



Collaborations

CSB-CMER&TI, Lahdoigarh in coordination with DoS Koraput, Odisha, is taking up muga rearing trials at Koraput, to improve muga seed availability in traditional muga areas in Northeast India during commercial season. The robust growth of muga larvae in non-traditional areas such as Odisha gives hope of reaching the national silk production target and thereby fulfilling the Sustainable Development Goal (SDG).





Constitution day

Every year on November 26, India celebrates Constitution Day, a day marking the adoption of the country's constitution in 1949. By reciting the "Preamble to the Constitution," CSB-CMER&TI, Lahdoigarh, commemorate the principles that form the basis of democracy and the bonds that unite us.



Development of Women Entrepreneurs in Eri Culture

In commemoration of the Platinum Jubilee of the CSB, CMER&TI, Lahdoigarh hosted a significant workshop on November 29, 2023, centred around the theme of "Development of Women Entrepreneurs in Eri Culture." The event unfolded at the institute premises, bringing together 150



farmers, beneficiaries, and entrepreneurs involved in Eri-culture. The workshop featured esteemed dignitaries, with Prof. Ajanta B. Rajkonwar, Hon'ble VC of Assam Women's University, Jorhat, serving as the Chief Guest. Dr. Nitin Kulkarni, Director of the Rain Forest Research Institute in Jorhat, graced the occasion as the Guest of Honour, while Dr. K. M. Vijaya Kumari, Director of CSB-CMER&TI, Lahdoigarh, presided over the event. Special recognition was extended to Smt. Kaveri Kachari Rajkonwar, who participated as a special invitee. Four prominent farmers were honoured for their commendable contributions and progressive efforts in advancing livelihoods through the Eri silk sector. The overarching theme of the workshop, "Development of Women Entrepreneurs in Eri Culture," emphasized the importance of gender inclusivity and empowerment in the realm of Eri culture entrepreneurship. The Technical Sessions were taken up by, Dr. Mahesh D S Sci-C & Dr. Manjunath R N Sci-C, illuminating technology interventions in both the pre-cocoon and post-cocoon sectors. In addition, Mrs. Kaveri Kachari Rajkonwar delivered a presentation highlighting the entrepreneurial prospects within the realm of Eri culture.

Muga Rearing Progress at Similiguda, Koraput, Odisha

A team of scientists visited the Mulberry Demonstration Farm in Similiguda, Koraput, Odisha on November 19, 2023, to monitor the progress of Muga silkworm rearing. The objective was to observe the growth and development of the silkworms and provide guidance to ensure optimal results. Healthy fifth-instar Muga silkworms were observed, indicating positive growth. A minor fungal disease was noted in some silkworms, which were manually collected and disposed of. On-site instructions were provided on disease





monitoring and intervention. It was concluded that the Muga-rearing progress was promising. A substantial Muga crop harvest is anticipated, which will be significant for Odisha. The success of Muga cultivation in Koraput during the summer could utilize the region's suitable conditions as an alternative to Assam which faces increased mortality during this period. Continued monitoring and staff training on disease identification and control were recommended to improve the Muga-rearing process further. The visit revealed the potential of Muga silk production in Koraput, especially during the summer months.

Potential for muga silkworm rearing in Mizoram

A technical visit to Mizoram explored the feasibility of rearing Muga silkworms during the summer months of July-September, traditionally done in Assam. Due to climate change, Assam faces increased disease risks in Muga silkworm rearing because of higher temperatures and humidity. Mizoram, with its milder summer temperatures ranging between 20-29°C, presents a promising alternative. Under the North Eastern Region Textile Promotion Scheme (NERTPS), the state has developed infrastructure like som plantations and cocoon mounting houses conducive for Muga silkworm rearing. The visit involved surveys of som plantations and discussions with local farmers, revealing well-maintained plantations, suitable temperatures below 30°C, and farmers' openness to adopting new technologies despite minimal knowledge. However, challenges such as variability in som plant quality, remote plantation locations, and transportation difficulties were identified. The technical team recommends conducting trial-rearing sessions, providing farmer training, identifying suitable som plant varieties, and addressing logistical challenges. It is concluded that Mizoram has significant potential to become a major muga silkworm producer by leveraging its existing infrastructure and favourable weather conditions during the summer months.

Workshop

CSB-CMER&TI, Lahdoigarh, hosted a crucial workshop on "Prevention of Sexual Harassment at Workplace" on 13.12.2023. The invited guest Advocate Mrs. Manshi Mech' and Smt. Asmat Jan, Assistant Director (Comp) & member of the Internal Complaints Committee (ICC-Women), CSB-CMER&TI, Lahdoigarh, delivered an enlightening talk, shedding light on essential aspects of creating a safe and respectful work environment.





Hindi workshop

CSB-CMER&TI, Lahdoigarh, has organized a one-day enlightening Hindi workshop on December 30th, 2023, headed by Director Dr. M. Vijaya Kumari. Assistant Director (Hindi) Mrs. H. Mangalam Devi welcomed Trained Graduate Teacher (TGT) Mr. Nikhilesh Kumar Shukla from Jawahar Navodaya Vidyalaya, Titabar, Jorhat as a Guest Teacher in the Workshop. He shared valuable information on the "simple use of Raj bhasha language Hindi in office".



The 43rd Research Advisory Committee Meeting of CSB-CMER&TI was held on 22nd March 2024 under the chairmanship of Dr. B C Deka, Vice Chancellor, Assam Agricultural University, Jorhat at CSB-CMER&TI, Lahdoigarh, Assam. The meeting was graced by the presence of eminent scientists including Dr. Nitin Kulkarni, Director, RFRI, Jorhat; Dr. Kartik Neog, Director, MESSO, Guwahati; B.K. Singh, Rtd. Director (CSB-CMER&TI, Lahdoigarh); Dr. N. Ibotombi Singh, Scientist-D (Rtd.) (CSB-CMER&TI, Lahdoigarh); Dr. Palash Debnath, Prof. & Head of Dept. of Plant Pathology, AAU; Dr. Sheik Nazeer Ahmed Saheb, Scientist-D, RCS, Central Silk Board, Bangalore; and Dr. K. M. Vijaya Kumari; Director, CSB-CMER&TI, Lahdoigarh. The meeting was festooned by Dr. N. B. Chowdary, Director, CTR&TI, Ranchi, and Shri N. Giridhar Srinivas, Deputy Director, SMOI as special invitees. The meeting also saw the presence of officers from the Department of Sericulture, Assam; Shri Sanjay Rai, Additional Director, DoS, Govt. of Nagaland; and Shri Hema Chandra Baruah, Rearer Representative, North Lakhimpur, Assam; Shri Binod Borah, Reeler Representative, Sivasagar, Assam. The efforts for improving Muga and Eri culture were greatly appreciated and the future challenges to focus on and work on were identified. The meeting ended with the concluding remarks from RAC Members and the Chairman.





PUBLICATIONS OF THE INSTITUTE (2023-24)

Research Papers

1. Subrahmanyam, G., Thirupathaiah, Y., Vijay, N. Debnath R, Arunkumar KP, Gadwala M, Sangannavar PA, Moorthy SM and Chutia M (2024) Contrasting gut bacteriomes unveiled between wild *Antheraea assamensis* Helfer (Lepidoptera: Saturniidae) and domesticated *Bombyx mori* L. (Lepidoptera: Bombycidae) silkworms. Mol Biol Rep 51, 666. <https://doi.org/10.1007/s11033-024-09629-9>
2. Dubey H, Pradeep AR, Neog K, Debnath R, Aneesha PJ, Shah SK, Kamatchi I, Ponnuvel KM, Ramesha A, Vijayan K, Nongthomba U, Bora U, Vankadara S, VijayaKumari KM, Arunkumar KP (2024) Genome sequencing and assembly of Indian golden silkmoth, *Antheraea assamensis* Helfer (Saturniidae, Lepidoptera). Genomics. 9;116(3):110841. doi: 10.1016/j.ygeno.2024.110841. Epub ahead of print. PMID: 38599255.
3. Subrahmanyam, G., Ponnuvel, K. M., Arunkumar, K. P., Rahul, K., Moorthy, S. M., & Sivaprasad, V. (2023). Molecular methods for diagnosis of microbial pathogens in muga silkworm, *Antheraea assamensis* Helfer (Lepidoptera: Saturniidae). International Journal of Industrial Entomology, 47(1), 1–11. <https://doi.org/10.7852/IJIE.2023.47.1.1>
4. Ashalatha, K.L., Arunkumar, K.P. and Gowda, M., 2023. Genomic and transcriptomic analysis of sacred fig (*Ficus religiosa*). BMC genomics, 24(1), p.197.
5. Debbarma J, Saikia B, Singha DL, Das D, Keot AK, Maharana J, Velmurugan N, Arunkumar KP, Palakolanu SR and Chikkaputtaiah C (2023) CRISPR/Cas9 mediated mutation in XSP10 and SISAMT genes impart genetic tolerance to Fusarium wilt disease of tomato (*Solanum lycopersicum* L.) Genes 14: 488. <https://doi.org/10.3390/genes14020488>.
6. Y. Debaraj, S. Subharani and Subadas Singh (2024). Efficacy of different egg laying devices and egg laying pattern of oak tasar silkmoth, *Antheraea proylei* Jolly. In International Journal of Research and Analytical Reviews, Vol.11 (1), 184-188.
7. Balakrishnan, I.K, Sakshi, K, S, Khajje, D, Dubey, H, Shantibala T, Subharani, S, Gangavarapu, S, Kobayashi, K, Ponnuvel, K.M and Debnath, R (2023). Comparative Pan-genomics of Group I Nucleo polyhedroviruses infecting *Antheraea proylei* and saturniid/bombycid silkmoths reveals genomic reassortments and divergences. Int. J. Wild Silkmoth& Silk 24, 21–38.
8. केएम विजया कुमारी, धर्मेन्द्र कु. जिज्ञासु, केपी अरुणकुमार, डीएस महेश, सुबादास सिंह, अमित कुमार, जेम्स कीसा, रीता लुखम, आफताब ए. शबनम (2023). मूगा और ऐसी सेरीकल्चर: उत्पादन और उत्पादकता में सुधार के लिए चुनौतियाँ, अवसर और दृष्टिकोण. In राष्ट्रीय राजभाषा तकनीकी सेमिनार- समग्र रेशम उत्पादन- चुनौतिया एवं भावी रणनीति, 12-17. ISBN 978-81-958770-1-0 (Lead Paper).
9. L. M. Borah, G. Subrahmanyam, D. J. Gogoi, S. Shah, D. S. Mahesh, K. M. Vijayakumari, C. Chikkaputtaiah and K. P. Arunkumar (2023), Cross-transmission of a microsporidian pathogen from muga silkworm, *Antheraea assamensis* Helfer to eri silkworm, *Samia ricini*. Sericologia, 62 (2): 96 – 105.





Books / Book Chapters / Manuals

1. Shabnam AA, Arunkumar KP, Kumar A, Jigyasu DK, (2024). Handbook of muga culture. CSB-Central Muga Eri Research and Training Institute, Lahdoigarh, Jorhat, Assam, India, Book no. 1, pp-210. ISBN: 978-81-959292-8-3.
2. Vijay N, Diganta Mech, Spinning Gold, Success Stories in Vanya Sericulture (2023), ISBN: 978-81-959292-9-0.
3. Subadas Singh, DK Jigyasu, OP Patidar, Amit Kumar and Aftab A. Shabnam (2023). Eri Silk Insect (Samiaricini, Donovan). In Commercial Insects, CRC Press, Taylor & Francis Group (eds. Omkar), 103-125p (ISBN: 978-1-032-59495-8 (hbk), ISBN: 978-1-032-59496-5 (pbk), ISBN: 978-1-003-45496-0 (ebk).
4. Jigyasu, D K, Patidar OP, Kumar A and Shabnam AA. (2024), Muga Silk Insect (*Antheraea assamensis*). In: Omkar (Ed.), Commercial Insects. CRC press, Taylor & Francis Group, (ISBN: 978-1-032-59495-8 (hbk), ISBN: 978-1-032-59496-5 (pbk), ISBN: 978-1-003-45496-0 (ebk)
5. Jigyasu *et al.* 2023, Castor plant in Ericulture: opportunities and challenges. In: Baudhh K, Singh RP (Ed.), Castor: A Climate Resilient Commercial Crop. Springer Nature, (In Press).
6. Saini, P., Rohela, G.K., Kumar, J.S., Shabnam, A.A., Kumar, A. (2023). Cultivation, Utilization, and Economic Benefits of Mulberry. In: Gnanesh, B.N., Vijayan, K. (eds) The Mulberry Genome. Compendium of Plant Genomes. Springer, Cham. Pp: 13-56. https://doi.org/10.1007/978-3-031-28478-6_2. Print ISBN: 978-3-031-28477-9.
7. Kaisa K, Tiwari J, Mahesh DS, Shah S, and Arunkumar KP* (2024) Biotechnological Approaches in Wild Silk Culture. In: Biotechnology for Silkworm Crop Enhancement - Tools and Applications. ISBN - 978-981-97-5060-3.
8. Mahesh D S., K P Arunkumar, and KM Vijaya Kumari, A manual on Eri Chawki Rearing (2024), ISBN: 978-81-959292-6-9.
9. Manjunath R N, Silk-cotton blend textiles: elevating everyday comfort with luxury (2024). In Book - The Cotton path: from farm to wardrobe, ISBN: 978-81-959422-9-9.
10. Debaraj, Y., Subharani, S., Devi, T.B and Devi, N.M. (2023). Biology of *Scymnus posticalis* Sicard (*Coleoptera: Coccinellidae*) reared on *Dialeuropora decempuncta* (Quaintance and Baker) (*Homoptera: Aleyrodidae*). Science for Sustainable Development. Akansha Publishing House, Darya Ganj, New Delhi 100pp.
11. Saini, P., Rohela, G.K., Kumar, J.S., Shabnam, A.A., Kumar, A. (2023). Cultivation, Utilization, and Economic Benefits of Mulberry. In: Gnanesh, B.N., Vijayan, K. (eds) The Mulberry Genome. Compendium of Plant Genomes. Springer, Cham. Pp: 13-56. https://doi.org/10.1007/978-3-031-28478-6_2. Print ISBN: 978-3-031-28477-9.

Patent Granted

1. A device for cocooning Eri, Muga & Mulberry, Granted - 14.03.2024, Patent No. 526129





Leaflet/Brochure/ Technical Bulletins

1. Subharani, S., Singh, D.L., Subadas, Kh., Somen, L. and Debaraj, Y. (2023) Diseases and its management in oak tasar culture (Bilingual) pp 8.
2. Subadas, Kh., Singh, S.K., Subharani, S., Somen, L. and Debaraj, Y. (2023). Package of practices in Eri culture in local language. 4pp
3. Mahesh D S., K P Arunkumar, Reeta Luikham and KM Vijaya Kumari (2023), Disinfection and hygiene maintenance in eri silkworm rearing, CMER&TI Technical Bulletin 01/2023 (English & Assamese Language), ISBN: 978-81-959292-4-5.
4. Manjunath R. N (2023), Muga Super Cook: A multiuse cooking solution for muga cocoons, CMER&TI Technical Bulletin (English & Assamese), ISBN: 978-81-959292-3-8.
5. K M Vijayakumari, P D Kamala Jayanthi, R. Gokulraj, Jayashree Mekali, Kartik Neog, D.K.Gogoi and T James Keisa (2023), Host plant volatiles (Synthetic blend): Oviposition stimulant blend for enhancing egg laying in from muga (*Antheraea assamensis*) and eri silk moth (*Samia ricini*), CMER&TI Technical Bulletin : APS 5001EF (English & Assamese Language), ISBN: 978-81-959292-5-2.
6. D. K Jigyasu, Aftab A Shabnam, Om Prakash Patidar.; Borpat (*A. grandis*) Nursery Raising Technique & Management (2024).
7. 20 Success stories of Muga clusters, Spinning Gold, Success Stories in Vanya Sericulture (2023), ISBN: 978-81-959292-9-0.

Abstracts

1. D K Jigyasu *et al.*, Aftab A. Shabnam, Om Prakash Patidar, Amit Kumar and K.M. Vijayakumari (2023). International Conference on “Biodiversity, Food Security, Sustainability and Climate Change” (ICBFSCC-2023), 25-28 April, 2023, Asam Agricultural University, Jorhat.
2. KP Arunkumar *et al.*, A Dual-Purpose Cold Reeling Technology to Improve Seed Availability in Muga Ecosystem, National Conference on "Silkworm Seed Industry: Opportunities and Future Prospects" Bengaluru, 30th - 31st January 2024
3. DS Mahesh, Lalitha Natarajan, Jyoti Ranjan Mishra, Arunima Nath, Ramen Bhuyan, Rubi Sut, KP Arunkumar, Kartik Neog and KM Vijaya Kumari, A New Method for Large-Scale Commercial Loose Egg Production in Ericulture, National Conference on "Silkworm Seed Industry: Opportunities and Future Prospects" Bengaluru, 30th - 31st January 2024.
4. Reeta Luikham L. *et al.*, Moth Emergence Pattern and Grainage Performance of *Antheraea Proylei* Jolly for Spring and Autumn Crop, National Conference on "Silkworm Seed Industry: Opportunities and Future Prospects" Bengaluru, 30th - 31st January 2024.
5. Aftab A. Shabnam *et al.*, Genetic Enhancement of Eri Silkworm (*Samia ricini*): A Comprehensive Study on Intra-Specific Hybridization for Improved Fecundity and Rearing Performance, National Conference on "Silkworm Seed Industry: Opportunities and Future Prospects" Bengaluru, 30th - 31st January 2024.





6. L. Somen Singh *et al.*, Studies on the Grainage performance of oak tasar vanya silkworm, *Antheraea frithi* Moore during Spring, Summer and Autumn crops in Manipur, National Conference on "Silkworm Seed Industry: Opportunities and Future Prospects" Bengaluru, 30th - 31st January 2024.
7. N Vijay *et al.*, Advancing Pebrine Identification in Muga Sericulture Through Artificial Intelligence: A Comprehensive Approach, National Conference on "Silkworm Seed Industry: Opportunities and Future Prospects" Bengaluru, 30th - 31st January 2024.
8. D K Jigyasu, *et al.*, Exploring the Impact of Host Plant Variability on The Reproductive Performance of Muga Silkworm (*Antheraea assamensis* Helfer), National Conference on "Silkworm Seed Industry: Opportunities and Future Prospects" Bengaluru, 30th - 31st January 2024
9. DS Mahesh *et al.*, Black Boxing Schedules for Synchronization Hatching in Ericulture, National Conference on "Silkworm Seed Industry: Opportunities and Future Prospects" Bengaluru, 30th - 31st January 2024
10. O P Patidar *et al.*, Utilisation of Girdling procedure in Borpat (*Ailanthus grandis*) for its asexual reproduction and enhancing leaf yield for sustainable ericulture development, International Conference on "Biodiversity, Food Security, Sustainability and Climate Change" (ICBFSCC-2023), 25-28 April, 2023, Asam Agricultural University, Jorhat
11. Mahesh D S *et al.*, Eri pupa-based diet for improving nutritional status of northeast india International Conference on "Biodiversity, Food Security, Sustainability and Climate Change" (ICBFSCC-2023), 25-28 April, 2023, Asam Agricultural University, Jorhat.
12. Subadas Singh *et al.*, Establishment of In-situ conservation sites of Muga silkworm, *Antheraea assamensis* Helfer-A crucial step to protect important bioresource, International Conference on "Biodiversity, Food Security, Sustainability and Climate Change" (ICBFSCC-2023), 25-28 April, 2023, Asam Agricultural University, Jorhat
13. Aftab A. Shabnam *et al.*, Technological interventions for improvement of Muga (*Antheraea assamensis*) and Eri (*Samia ricini* D) silkworm Host Plants, International Conference on "Biodiversity, Food Security, Sustainability and Climate Change" (ICBFSCC-2023), 25-28 April, 2023, Asam Agricultural University, Jorhat.
14. KP Arunkumar *et al.*, Strategies to mitigate climate change impact on muga sericulture ecosystem in Northeast India, International Conference on "Biodiversity, Food Security, Sustainability and Climate Change" (ICBFSCC-2023), 25-28 April, 2023, Asam Agricultural University, Jorhat
15. D K Jigyasu, *et al.*, Seri-agro-forestry convergence for promotion of vanya sericulture in Northeast India, International Conference on "Biodiversity, Food Security, Sustainability and Climate Change" (ICBFSCC-2023), 25-28 April, 2023, Asam Agricultural University, Jorhat
16. Manjunath R N., Unleashing 3D Woven Silk Fabrics for Designing Apparel and Technical Textiles" International Conference on Global Scenario and Sustainable Solutions in Silk Industry, February 28, 2024, New Delhi.
17. Manjunath R N., From Tradition to Innovation: Harnessing the power of 3D woven silk fabrics for technical textiles, Indo-Japan Textile Research Conference, 27th-28th November 2023, IIT Delhi.





18. इण्डियन सिल्क में लोक प्रिय लेख हिंदी गुजरात में एरी रेशम कीटपालन एवं उसकी सम्भावनाएं स्वीकार्य 21.04.2023 लेखक- सूरज पाल, धर्मेन्द्र कुमार जिज्ञासू एवं के०एम० विजय कुमारी
19. इण्डियन सिल्क में लोक प्रिय लेख हिंदी एरी रेशम कीटपालन में किसान कौशल प्रशिक्षण का प्रभाव स्वीकार्य – 24.04.2023 लेखक- सूरज पाल, धर्मेन्द्र कुमार जिज्ञासू एवं के०एम० विजय कुमारी
20. नगर राजभाषा कार्यान्वयन समिति फतेहपुर (उ०प्र०) छमाही पत्रिका सृजन के चौथे अंक में लेख प्रकाशित – एक सूत्र में पिरो रहा है रेशम भारत को – लेखक- सूरज पाल, वैज्ञानिक-डी , एरी अनुसंधान प्रसार केंद्र फतेहपुर (अगस्त, 2023)
21. जंगली बारहमासी और वार्षिक खेती की गई अरंडी (रिकिनस कम्युनिस एल.) असेसन्स के बीजों का मॉर्फो-मीट्रिक लक्षण विश्लेषण अध्ययन, “केन्द्रीय रेशम बोर्ड के 75 साल: उपलब्धियां एवं भावी परिदृश्य” विषय पर राष्ट्रीय राजभाषा तकनीकी सेमिनार दिनांक 15.02.2024.
22. एरी रेशम मूल्य श्रृंखला में वैज्ञानिक तकनीकों के माध्यम से महिला सशक्तिकरण को प्रोत्साहन, “केन्द्रीय रेशम बोर्ड के 75 साल: उपलब्धियां एवं भावी परिदृश्य” विषय पर राष्ट्रीय राजभाषा तकनीकी सेमिनार दिनांक 15.02.2024.
23. तकनीकी अभिगम और असमके आदिवासी क्षेत्रमें सामाजिक-आर्थिक प्रभावद्वारा सततविकास, “केन्द्रीय रेशम बोर्ड के 75 साल: उपलब्धियां एवं भावी परिदृश्य” विषय पर राष्ट्रीय राजभाषा तकनीकी सेमिनार दिनांक 15.02.2024.
24. धर्मेन्द्र कुमार जिज्ञासु et al., पूर्व-बीज और बीज फसल के दौरान मूगा रेशमकीट (एंथेरिया असामेन्सिस हेल्फर) का विभिन्न खाद्य पौधों पर अलग-अलग और संयोजन में कीटपालन का प्रभाव, “केन्द्रीय रेशम बोर्ड के 75 साल: उपलब्धियां एवं भावी परिदृश्य” विषय पर राष्ट्रीय राजभाषा तकनीकी सेमिनार दिनांक 15.02.2024.

AWARDS / Recognition

1. Dr. Aftab A Shabnam, Scientist-D received 2nd Best Presentation for presenting a research paper at “International Conference on Silkworm Seed Industry: Opportunities and Future Prospects” held at National Institute of Fashion Technology, Bengaluru Organized by Central Silk Board, Bengaluru (Karnataka) during 30th-31st January 2024.
2. Dr. Laishram Somen Singh, Scientist-D received 3rd Best oral paper presentation award for the paper entitled “Studies on the grainage performance of oak tasar vanya silkmoth, *Antheraea frithi* Moore during spring, summer and autumn crops in Manipur”.
3. Dr. Sinam Subharani Devi, Scientist-D received 3rd Best poster presentation award for the paper entitled “Impact of host plant derived leaf and stem extracts on the oviposition behavior of the temperate tasar silk moth, *Antheraea proylei*”.
4. डॉ. मंजूनाथ आर.एन., वैज्ञानिक-सी (आर एंड एस) को प्रथम मौखिक प्रस्तुति प्राप्त हुई केन्द्रीय रेशम बोर्ड के 75 साल: उपलब्धियां एवं भावी परिदृश्य” विषय पर राष्ट्रीय राजभाषा तकनीकी सेमिनार दिनांक 15.02.2024.





GRANTS –IN-AID FOR THE YEAR 2023-24

Head	GIA RECEIVED	EXPENDITURE INCURRED	SURRENDERED
Plan (NE General)	2,82,50,000 /-	2,82,50,000 /-	-
Plan Capital	1,42,31,081 /-	1,42,31,081 /-	
Plan (NE Capital)	55,88,014 /-	55,88,014 /-	-
Total	4,80,69,095 /-	4,80,69,095 /-	-

EXTERNAL FUND BALANCES FOR THE YEAR 2023-24

Head	DBT Fund	DST FUND
Opening Balance as on 01.04.2023	4,26,846 /-	2,83,992 /-
Amount Received during the year (including interest)	4260525 /- 38519/- (interest)	21,108/- (interest)
Expenditure during the year	22,37,036 /-	16,157 /-
Surrendered during the year	20,23,765 /- 27,905.00 (interest)	-
Closing Balance	4,37,184 /-	2,88,943 /-





Progress at a glance for the year 2023-2024

Name of the Institute	Research Projects as PI			Research Projects as CI			On Station Trials		On Farm Trials			Capacity Building & Training		Extension Communication programmes (ECPs)		Soil Analysis services provided	Information, Education and Communication during	No. of patents filed/granted and technologies to be commercialised	Procurement of equipments (Amount spent -Rs in lakh)	Other activities	Revenue generated (Rs. in Lakhs)
	Ongoing projects during the year	Concluded Projects during the year	Newly initiated Projects	No. of technologies validated	No. of trials /locations covered		No. of technologies demonstrated	No. of locations covered	No. of stakeholders covered	No. of Programs Conducted	No. of stakeholders trained	No. of Programs Conducted	No. of stakeholders trained								
CMER&TI, Lahdoigarh	04	06	06													3	224	01	154	2.5	38.8