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वस्त्र मंत्रालय
MINISTRY OF
TEXTILES
सत्यमेव जयते

WILD SILKS OF INDIA
vanya

वार्षिक प्रतिवेदन

ANNUAL REPORT

2022-23

केन्द्रीय मूगा एरी अनुसंधान एवं प्रशिक्षण संस्थान
CENTRAL MUGA ERI RESEARCH & TRAINING INSTITUTE
केन्द्रीय रेशम बोर्ड Central Silk Board
वस्त्र मंत्रालय, भारत सरकार Ministry of Textiles, Government of India
लाहदोईगढ, जोरहाट (असम) Lahdoigarh, Jorhat-785 700, Assam, INDIA

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Central Muga Eri Research and Training Institute

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वस्त्र मंत्रालय, भारत सरकार Ministry of Textiles, Govt. of India

लाहदोईगढ़, जोरहाट, असम Lahd oigarh, Jorhat-785700, Assam

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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

संस्थान की वर्ष २०२२-२३ की वार्षिक रिपोर्ट प्रस्तुत करते हुए मुझे बेहद खुशी हो रही है। यह रिपोर्ट वर्ष के दौरान मूगा, एरी और ओक तसर रेशम उत्पादन के क्षेत्र में हमारे संस्थान के समर्पित प्रयासों और उल्लेखनीय उपलब्धियों को दर्शाती है। अनुसंधान और विकास के प्रति हमारी प्रतिबद्धता अटूट रही है, और इस रिपोर्ट में दिखाए गए परिणाम हमारे वैज्ञानिकों, शोधकर्ताओं और सहायक कर्मचारियों के सामूहिक प्रयासों को दर्शाते हैं। वर्ष २०२२-२३ को रेशम उत्पादन के विभिन्न पहलुओं में महत्वपूर्ण प्रगति द्वारा चिह्नित किया गया है, और मुझे कुछ मुख्य बातें साझा करते हुए अत्यंत खुशी हो रही है।

जैसा कि हम संस्थान के अस्तित्व के दो दशकों पर विचार करते हैं, हम पूर्वोत्तर भारत में वन्या रेशम उत्पादन के विकास के इतिहास में अपनी भूमिका पर गर्व करते हैं। इस क्षेत्र में कई तकनीकों की संकल्पना, विकास और प्रभावी ढंग से कार्यान्वयन किया गया है। इस समय, मैं संस्थान के समर्पित वैज्ञानिकों और सहयोगी कर्मचारियों के साथ-साथ उन हितधारकों की हार्दिक सराहना करता हूं जिन्होंने इन नवीन तकनीकों को अपनाया। इस सामूहिक प्रयास के माध्यम से हमने मूगा, एरी और ओक तसर क्षेत्रों में कच्चे रेशम उत्पादन में पर्याप्त वृद्धि देखी है।

मेजबान पादप (खाद्य) सुधार, उत्पादन और संरक्षण के क्षेत्र में, हमारे संस्थान ने अरंडी जीन पूल को समृद्ध करने और अरंडी जर्मप्लाज्म को चिह्नित करने में उल्लेखनीय प्रगति की है, जिससे बारहमासी अरंडी किस्म के विकास का मार्ग प्रशस्त हुआ है। लाभार्थियों को मूगा और एरी सुपीरियर होस्ट पौधों के लगभग १५००० पौधों की आपूर्ति ने किसानों के लगभग ३४ एकड़ में व्यापक वृक्षारोपण के प्रयासों का समर्थन किया है। लखीमपुर (असम) में वन्या रेशम उत्पादन की ऊपरी मिट्टी का पोषण मूल्यांकन और असम में मूगा उगाने वाले जिलों के लिए सेरी-जलवायु मैनुअल की तैयारी टिकाऊ रेशम उत्पादन प्रथाओं में महत्वपूर्ण योगदान है। इसके अलावा, मूगा रेशमकीटों पर बढ़े हुए कार्बन डाइआक्साईड और तापमान के प्रभाव की जांच बदलती पर्यावरणीय परिस्थितियों से उत्पन्न चुनौतियों से निपटने के लिए हमारी प्रतिबद्धता को रेखांकित करती है।

रेशमकीट सुधार, उत्पादन और संरक्षण के क्षेत्र में हमारे संस्थान की उपलब्धियाँ समान रूप से सराहनीय हैं। मूगा रेशमकीट में ग्रीष्म ऋतु की शिथिलता की पहचान, आंत माइक्रोबायोम का व्यापक लक्षण वर्णन, और वेब-सुलभ डेटाबेस "वन्या सिल्कबेस " का विकास वैज्ञानिक ज्ञान को आगे बढ़ाने के लिए हमारे समर्पण को दर्शाता है।

प्रौद्योगिकी हस्तांतरण में हमारे प्रयासों पर किसी का ध्यान नहीं गया, प्रशिक्षण कार्यक्रमों से मूगा आदिवासी किसानों को लाभ हुआ है जिससे कोकून उत्पादन और समग्र आय में उल्लेखनीय वृद्धि हुई है। इसके अतिरिक्त, वन्या रेशम कृषि मेलों, कार्यशालाओं, प्रदर्शनियों, क्षेत्र दिवसों और जागरूकता कार्यक्रमों जैसे कार्यक्रमों की एक श्रृंखला ने ज्ञान के प्रसार और रेशम उत्पादन क्षेत्र में हितधारकों के सशक्तिकरण में योगदान दिया है। मैं टिकाऊ और लाभदायक रेशम उत्पादन को बढ़ावा देने के मिशन के प्रति उनके अथक प्रयासों, नवीन दृष्टिकोण और समर्पण के लिए केन्द्रीय मूगा एरी अनुसंधान एवं प्रशिक्षण संस्थान की टीम के प्रति अपना आभार व्यक्त

करती हूँ। किसानों, शोधकर्ताओं और विभिन्न हितधारकों के साथ सहयोग ही हमारी सफलता के लिए महत्वपूर्ण रहा है।

केन्द्रीय मूगा एरी अनुसंधान एवं प्रशिक्षण संस्थान की सहायक इकाइयों ने सक्रिय रूप से अपने व्यक्तिगत उद्देश्यों को साकार करने का प्रयास किया है। क्षेत्रीय रेशम उत्पादन अनुसंधान केंद्र (आरएसआरएस), इंफाल ने ओक तसर रेशमकीटों पर केंद्रित अनुसंधान और विस्तार पहल के संचालन में अग्रणी भूमिका निभाई है। आरएसआरएस, बोको ने निचले असम और पश्चिम बंगाल में रेशम उत्पादन विशेषज्ञों की आवश्यकताओं को पूरा करने के लिए समर्पित 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 नई परियोजनाओं को शुरू करने और अनुमोदित परियोजनाओं के निर्बाध निष्पादन को सुनिश्चित करने में उनके अमूल्य इनपुट और दृढ़ समर्थन के लिए अनुसंधान सलाहकार समिति के अध्यक्ष और सदस्यों के प्रति अपनी हार्दिक कृतज्ञता व्यक्त करना चाहती हूँ। इसके अतिरिक्त, मैं केन्द्रीय मूगा एरी अनुसंधान एवं प्रशिक्षण संस्थान के विकास में उनके अटूट समर्थन के लिए केंद्रीय रेशम बोर्ड, बैंगलोर के सक्षम प्राधिकारी को हार्दिक धन्यवाद देती हूँ। मैं सभी पूर्वोत्तर राज्यों में राज्य रेशम उत्पादन विभाग द्वारा दिए गए सहयोगात्मक प्रयासों और समर्थन को ईमानदारी से स्वीकार करती हूँ और उनकी सराहना भी करती हूँ, जो विकासात्मक और विस्तार संचार कार्यक्रमों के सफल कार्यान्वयन में सहायक रहे हैं। सहयोगी संस्थानों और अनुसंधान निधि एजेंसियों का योगदान महत्वपूर्ण रहा है, और उनका समर्थन अत्यधिक मूल्यवान है।

जैसे-जैसे हम आगे बढ़ते हैं, हम रेशम उत्पादन अनुसंधान की सीमाओं को आगे बढ़ाने, तकनीकी प्रगति को बढ़ावा देने और जिन क्षेत्रों में हम सेवा करते हैं, उनके सामाजिक-आर्थिक विकास में योगदान देने के लिए प्रतिबद्ध हैं। मैं सभी हितधारकों को इस वार्षिक रिपोर्ट को समझने और इसका उपयोग करने के लिए आमंत्रित करती हूँ, जिसमें हमारे द्वारा की गई प्रगति और भविष्य के विकास के संभावित मार्गों को पहचानने में मदद मिल सके है। सभी का सहृदय धन्यवाद और आभार प्रकट करती हूँ।

के यम वि कुमारि

(डॉ. के.एम. विजया कुमारी)
निदेशक

Foreword

It gives me immense pleasure to present the Annual Report for the year 2022-23 of the Central Muga Eri Research & Training Institute, Lahdoigarh. This report encapsulates the dedicated efforts and remarkable achievements of our institute in the field of muga, eri, and oak tasar sericulture during the year. Our commitment to research and development has been unwavering, and the results showcased in this report reflect the collective endeavors of our scientists, researchers, and support staff. The year 2022-23 has been marked by significant strides in various facets of sericulture, and I am pleased to share some of the highlights.

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. 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, our institute has made noteworthy progress in enriching the castor gene pool and characterizing castor germplasm, paving the way for the development of a perennial castor variety. The supply of nearly 15,000 seedlings of Muga and Eri superior host plants to beneficiaries has supported extensive plantation efforts, covering approximately 34 acres of farmers' fields. The nutritional assessment of vanya sericulture top soils in Lakhimpur (Assam) and the preparation of a Seri-climatic manual for Muga growing districts in Assam are critical contributions to sustainable sericulture practices. Furthermore, the investigation into the impact of elevated CO2 and temperature on muga silkworms underscores our commitment to addressing challenges posed by changing environmental conditions.

In the realm of Silkworm Improvement, Production, and Protection, our institute's achievements are equally commendable. The identification of summer aestivation in muga silkworm, comprehensive characterization of gut microbiome, and the development of the web-accessible database "Vanya Silkbase" demonstrate our dedication to advancing scientific knowledge.

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.

I extend my gratitude to the team at CMER&TI for their relentless efforts, innovative approaches, and dedication to the mission of promoting sustainable and profitable sericulture. The collaboration with farmers, researchers, and various stakeholders has been pivotal to our success.

The subsidiary units of 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 inputs 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 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 Central Silk Board (CSB), Ministry of Textiles, Govt. of India in 1999, Central Muga Eri Research & Training Institute (CMER&TI) has been the premier R&D centre catering to the needs of vanya sericulture industry in Northeast India. Situated in Northeast India, a proud producer of all types of vanya silks, CMER&TI focuses mainly on R&D activities in muga, eri and oak tasar culture. The institute is strengthening the infrastructural facilities in recent years for conducting research in the frontier areas. The main objectives of the institute are to evolve new technologies for increasing the productivity of muga, eri and oak tasar silkworms and thereby transforming these cultures from the state of traditional culture to a profit making and sustainable enterprises.

The institute is located at Lahdoigarh, 16 km east of Jorhat, Assam, well connected with road. It has extension units in the North Eastern States, West Bengal and Uttar Pradesh. Scientists are working in close coordination towards the development of farmer friendly technologies, their application in field, evaluation and fine tuning of the technologies and its dissemination. Research and Developmental activities of this institute are carried out under six divisions. There is a Project Monitoring Cell (PMC) in the institute for planning and monitoring of the institutional R&D activities. The administrative activities are carried out by ten sections viz., Establishment, Accounts & Bill, Stores and Purchase, Library, Vehicle, Construction, Labour, Computer, Hindi and Receipt & Dispatch.

To facilitate effective transfer of technologies developed by the institute and their validation in the fields, two Regional sericulture Research Stations (RSRS) viz., RSRS Boko, Assam, and RSRS Imphal, Manipur along with three Research Extension Centres (REC) have been established. The regional stations are located in major sericulture zones to carry out region and season specific research and to facilitate test verification and effective dissemination of laboratory findings to the field. The research station situation at Boko is dedicated to Muga related research while the research station at Imphal is dedicated to Oak tasar. The regional stations, along with the RECs under their control, are working towards identification of technologies suitable to regional needs and their diffusion to field. RECs for muga are located at Coochbehar (West Bengal) and Lakhimpur (Assam). Field Laboratory T. Khullen under the control of RSRS Imphal is sharing the responsibility of transferring the technologies to the beneficiaries involved Oak tasar sericulture. There is one REC for eri culture is located at Fatehpur, Uttar Pradesh.

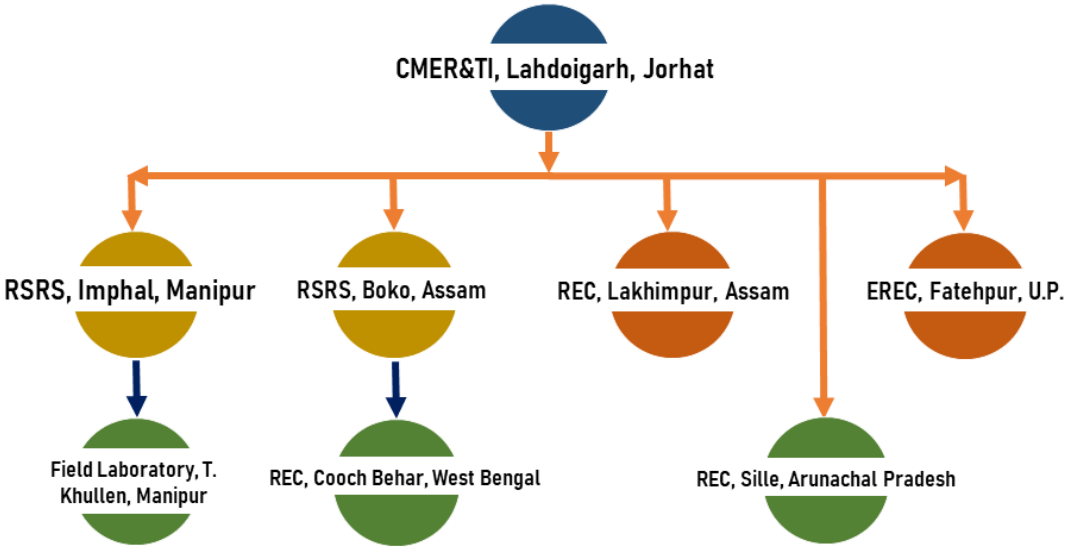
MANDATE OF THE INSTITUTE

- 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.

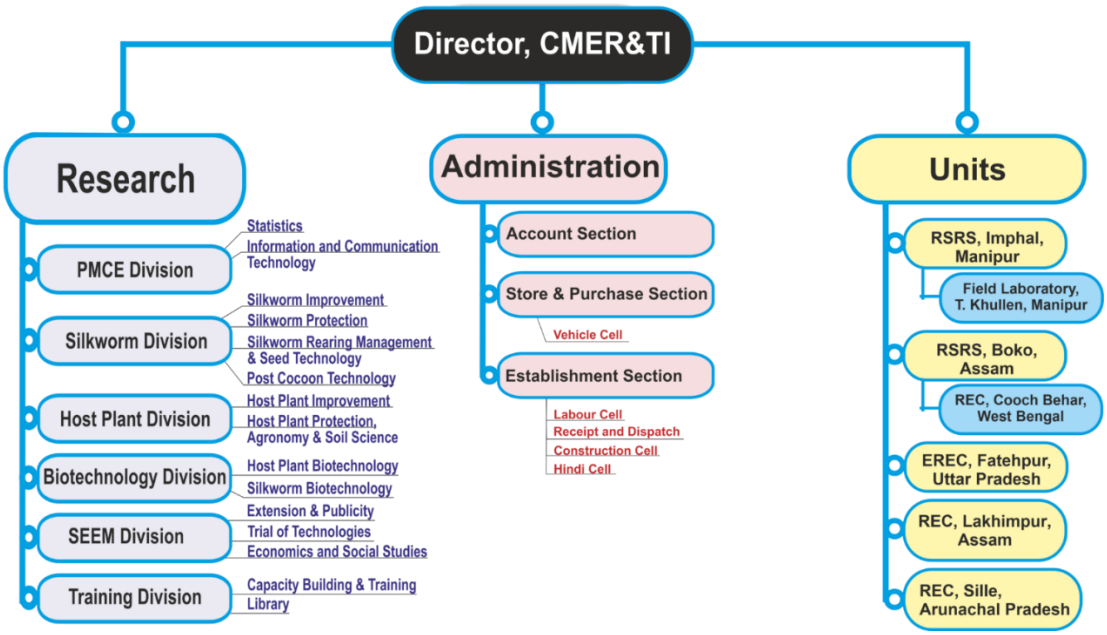
HUMAN RESOURCES (as on 31.03.2023)

Sl. No.	Staff	Main institute	RSRS (Boko+Imphal)	RECs
1	**Scientists**			
	Scientist-D	4	1+3	1
	Scientist-C	7	0+1	1
	Scientist-B	0	0	0
	Sub-Total	**11**	**5**	**2**
2	STA/ SFA/FA	**15**	**3 +12 = 15**	**11**
3	**Administrative staff**			
	AD (A&A) & AD (Com)	**0+1**	**0**	**0**
	Asst. Supt	**02**	**0**	**0**
	UDC/LDC	**03**	**0**	**0**
	Stenographer	**01**	**0**	**0**
	Ass. Technician	**02**	**1+1**	**2**
	Hindi translator	**0**	**0+1**	**0**
	Driver	**1**	**0+1**	**1**
	MTS	**06**	**2+3**	**4**
	Sub-Total	**16**	**3+6 = 09**	**7**
	G. Total	**42**	**29**	**20**

EXTENSION NETWORK



ORGANIZATIONAL SETUP



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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

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मुख्य उपलब्धियों (२०२२-२३)

केंद्रीय मूगा एरी अनुसंधान एवं प्रशिक्षण संस्थान, लहदोईगढ़, जोरहाट, आरएसआरएस, बोको, आरएसआरएस, इम्फाल और लखीमपुर (असम), कूचबिहार (पश्चिम बंगाल) और फतेहपुर (उत्तर प्रदेश) में स्थित अनुसंधान विस्तार केंद्र के नेटवर्क के साथ मूगा, एरी और ओक तसर उद्योग विशेष रूप से देश के पूर्वी और उत्तर-पूर्वी क्षेत्रों में विकास के लिए अनुसंधान एवं विकास सहायता प्रदान करता है।।

वर्ष २०२२-२३ के दौरान किए गए शोध कार्यों का संक्षिप्त विवरण नीचे प्रस्तुत किया गया है:

मेजबान संयंत्र सुधार, उत्पादन और संरक्षण

- ०५ और अरंडी जीन पूल के बारहमासी परिग्रहणों (accessions) को पूर्वोत्तर क्षेत्र से एकत्र कर किए समृद्ध किया गया। अरंडी जर्मप्लाज्म बैंक में १७ परिग्रहणों को बीज विशेषताओं, मॉर्फो-मीट्रिक, जैव रासायनिक और बायोएसे लक्षणों (कुल ९२ लक्षण) के आधार पर चिह्नित किया गया था। अक्टूबर२०२२ में रांची में आयोजित वन्या रेशम संगोष्ठी के दौरान अरंडी जर्मप्लाज्म के लक्षण वर्णन पर एक डिस्क्रिप्टर-सह-कैटलॉग पुस्तक को प्रकाशित और लोकार्पण किया गया था।
- बेहतर विशेषताओं के साथ बारहमासी अरंडी किस्म के विकास के लिए संकरण कार्यक्रम में संभावित अरंडी परिग्रहण का उपयोग किया गया था। जिसमें एफ$_2$ पीढ़ी में १२ बारहमासी पौधों का चयन किया गया और एफ$_3$ पीढ़ी में पौधे से पंक्ति तक अरंडी किस्म को पैदा किया गया।
- इस वर्ष के दौरान 156 लाभार्थियों को मूगा और एरी सुपीरियर होस्ट पौधों के 14,968 पौधे प्रदान किए गए। इससे किसानों के लगभग 34 एकड़ खेतों में बेहतर मेजबान पौधों के रोपण को बढ़ाने में मदद मिली है।
- लखीमपुर (असम) में वन्या रेशम उत्पादन की ऊपरी मिट्टी के पोषण स्थिति का आकलन किया गया और सूक्ष्म और स्थूल पोषक तत्वों की उपलब्धता को दर्शाने के लिए स्थानिक वितरण मानचित्र भी तैयार किए गए। गुणवत्तापूर्ण मूगा और एरी रेशम उत्पादन के लिए पोषक तत्वों की कमी वाली मिट्टी को समृद्ध करने के लिए सुधारात्मक उपाय सुझाए गए थे।
- चार खाद्य पौधों सोम (*पर्सिया बोम्बीसीना*), सोआलू (*लिट्सिया मोनोपेटाला*), दिघलोटी (*लिट्सिया सैलिसिफोलिया*) और मजंकरी (*लिट्सिया क्यूबेबा*) पर विभिन्न मौसमों में मूगा रेशमकीट पालन और बीजागार प्रदर्शन के तुलनात्मक अध्ययन से सोम + सोआलू तथा सोआलू+ सोम और इसके बाद दिघलोटी के साथ संयोजन की श्रेष्ठता का पता किया गया।
- असम के मूगा उत्पादक जिलों का "सेरी-जलवायु मैनुअल" तैयार और प्रकाशित किया गया है। यह असम के छात्रों, रेशम - उद्यमियों, वैज्ञानिकों और नीति निर्माताओं के लिए एक संदर्भ पुस्तक के रूप में काम आयेगी और मूगा उद्योग को बढ़ावा देने के लिए बदलते पर्यावरणीय परिदृश्यों के संबंध में गुणवत्तापूर्ण निर्णय लेने में मदद मिलेगी।
- ओपन टॉप चैम्बर के अंदर नियंत्रित परिस्थितियों में मूगा रेशमकीट और उसके प्रमुख खाद्य पौधे सोम (*पर्सिया बॉम्बाइसीना*) पर उच्च CO_2 और उच्च तापमान के उपचार से मूगा लार्वा और कोकून का वजन कम हो गया और खाद्य पौधे की पत्ती के जैव रासायनिक घटकों पर असर पड़ा, जो मूगा उद्योग पर बदलते पर्यावरण के प्रतिकूल प्रभाव को दर्शाता है।
- अमिश्रित और मिश्रित शहतूत पेय तैयार करने की प्रक्रिया को मानकीकृत किया गया है। ग्राहकों की प्रतिक्रिया प्राप्त करने के लिए प्रत्येक प्रक्रिया के 3000 नमूनों का मूल्यांकन किया गया। इससे अमिश्रित और मिश्रित शहतूत पेय पदार्थों का व्यावसायीकरण होगा।

रेशमकीट सुधार, उत्पादन और संरक्षण

- मूगा रेशमकीट (*एंथेरिया असामेन्सिस*) में ग्रीष्मकालीन शिथिलता के अस्तित्व की पहचान की गई, जिसमें जंगली मूगा गर्मियों के दौरान प्रतिकूल मौसम की स्थिति से उबरने के लिए गर्मी के मौसम (जुलाई-सितंबर) के दौरान आराम/नींद से गुजरता है। इस खोज से गर्म ग्रीष्मकाल के दौरान पालन से बचने के लिए शिथिलता मूगा वंशावली के विकास को बढ़ावा मिलेगा।
- मूगा और एरी रेशमकीट के आंत माइक्रोबायोम का व्यापक लक्षण वर्णन किया गया और देखा गया कि कीस्टोन माइक्रोबियल प्रजातियां मेजबान पौधों की प्रजातियों के आधार पर आंत में निवास करती हैं। लिग्नोसेल्युलोज क्षरण के लिए स्क्रीनिंग से जाइलन को क्षत-विक्षत करने में सक्षम एंजाइमेटिक रूप से संभावित रोगाणुओं को अलग किया गया है। इससे संपूर्ण जीनोम

अनुक्रमण और आनुवंशिक समूहों की पहचान द्वारा तनाव का लक्षण वर्णन किया गया है।

- वेब सुलभ डेटाबेस "वन्या सिल्कबेस" को विकसित किया गया है, जो वन्या रेशमकीट शोधकर्ताओं को जंगली रेशमकीट प्रजातियों में रुचि के जीन के उपयोग में मदद करेगा।
- NaOCl की तुलना में 4% निर्मूल उपचार से पेब्राइन बीजाणुओं का पूर्ण उन्मूलन प्राप्त किया गया। इसलिए, निर्मूल को अंडे के उपचार के लिए NaOCl के विकल्प के रूप में इस्तेमाल किया जा सकता है और मूगा पालन में क्षेत्रीय अनुप्रयोग के लिए भी इस्तेमाल किया जा सकता है।
- एरी रेशमकीट पालन में "अस्त्र" और "ब्लीचिंग पाउडर" आधारित कीटाणुशोधन अनुसूची और स्वच्छता रखरखाव विकसित किया गया और क्षेत्र परीक्षण में प्रदर्शित किया गया।
- आर्टिफिशियल इंटेलिजेंस और मशीन लर्निंग मॉडल का उपयोग करके पेब्राइन (*नोसेमा एसपी.* Aa1) की पहचान के लिए एक नई विधि विकसित की गई। वास्तविक समय पहचान और परिमाणीकरण के लिए मोबाइल आधारित एप्लिकेशन का विकास प्रगति पर है।
- एरी रेशमकीट सुधार कार्यक्रम के तहत, 04 इकोरेस (6 उपभेदों) में 100% एकरूपता हासिल की गई। प्योरलाइन माता-पिता की क्रॉसिंग 10x10 डायलल क्रॉसिंग में की गई थी । बोर्डुआर येलो प्लेन (बीवाईपी) को सर्वश्रेष्ठ सामान्य एरी रेशमकीट पाया गया। एससीए और पारस्परिक प्रभाव के आधार पर, तीन संकर सी2 x बी वाईपी, बी वाईपी x जीबीपी और जी वाईपी x टी जीबीपी को संस्थान स्तर पर सीमित परीक्षणों के लिए शॉर्टलिस्ट किया गया है।
- एरी चौकी पालन तकनीक को मानकीकृत किया गया और चॉकी एरी रेशमकीट पालन असम, नागालैंड और गुजरात के विभिन्न क्षेत्रों में कई प्रदर्शन और क्षेत्र परीक्षण किए गए। पारंपरिक पालन की तुलना में कोकून की उपज में 20% से अधिक की वृद्धि दर्ज की गई।
- एक नया कोकून उबालने का फॉर्मूलेशन जो मूगा कोकून को कुशल और समान पकाने की सुविधा प्रदान कर सकता है, को विकसित किया गया था और रीलिंग प्रदर्शन पर इसकी प्रभावकारिता के लिए परीक्षण भी किया गया था। परीक्षण के परिणामों ने रीलिंग प्रक्रिया के दौरान धागा टूटने में कमी (35-40% तक) और इसकी चमक और भौतिक गुणों को बनाए रखने के अलावा कच्चे रेशम की रिकवरी (8-10%) में सुधार का संकेत मिला। कोकून उबालने की अवधि में लगभग 60% कम हो गई और फॉर्मूलेशन मूगा और एरी कोकून दोनों को पकाने के लिए उपयुक्त पाया गया। कोकून उबालने के घोल को 2-3 बार प्रभावी ढंग से पुन: उपयोग भी किया जा सकता है जिससे इसमें शामिल सामग्रियों के संरक्षण में सहायता मिलती है।
- एरी और मूगा प्यूपा दोनों में पोषक तत्वों की संरचना और बायोएक्टिव यौगिकों का मूल्यांकन किया गया और आवश्यक अमीनो एसिड, फैटी एसिड, शर्करा, फ्लेवोनोइड, फेनोलिक एसिड और विटामिन सामग्री का विश्लेषण किया गया। एरी और मूगा प्यूपा दोनों में भारी धातुएं और एंटी-पोषक तत्व डब्ल्यूएचओ मानकों के अनुसार मनुष्यों के लिए हानिकारक स्तर से नीचे पाए गए।
- डीएनए अनुक्रमण द्वारा मृत मूगा प्यूपा में 7 जीवाणु प्रजातियों की पहचान की गई। माइक्रोबियल प्रजातियाँ, *एक्सिगुओबैक्टीरियम उंडे, एक्जिगुओबैक्टीरियम अंटार्कटिकम, पैन्टोइया* मूगा स्पेंट प्यूपा में *वेगन्स, एक्जिगुओबैक्टीरियम एसपी, बैसिलस थुरिंजिएन्सिस, स्टैफिलोकोकस कैपिटिस पाए* गए।
- सीएफटीआरआई द्वारा तैयार एरी प्यूपल स्नैक्स का पारंपरिक क्षेत्र (असम) के पैनलिस्टों द्वारा संवेदी मूल्यांकन के माध्यम से परीक्षण किया गया। विभिन्न तापमानों पर प्राकृतिक परिरक्षकों का उपयोग करके संरक्षित एरी प्यूपा का संवेदी मूल्यांकन के माध्यम से परीक्षण किया गया और कम तापमान (2- 8 डिग्री सेल्सियस) पर 4 दिनों तक संरक्षित प्यूपा को पैनलिस्टों द्वारा स्वीकार किया गया।
- *एंथेरिया फ्रिथि* के पालन और बीजागार की प्रौद्योगिकियों का व्यावसायिक रूप से अपनाने के लिए मानकीकरण किया गया। मणिपुर में वसंत (अप्रैल-मई) और शरद ऋतु (सितंबर-अक्टूबर) मौसम के दौरान *क्वार्कस सेराटा* और *क्वार्कस ग्रिफ़िथी की तुलना में लिथोकार्पस डीलबाटा की* पत्तियां खिलाने से पालन-पोषण का प्रदर्शन बेहतर पाया गया। जब कीड़ों को *एल. डीलबाटा* पत्ते खिलाने से आर्थिक मानदंड जैसे कि कोकून प्रति डीएफएल (42 संख्या), कोकून का वजन (4.50 ग्राम), खोल का वजन (0.52 ग्राम) और खोल का अनुपात (11.55%) वसंत की फसल के दौरान अधिक दर्ज किए गए।
- मणिपुर की विभिन्न कृषि -जलवायु स्थितियों के लिए उपयुक्त विभिन्न एरी रेशमकीट इकोरेस, उपभेदों (strains) और नस्लों

(breeds) को बनाए रखा गया। तुलनात्मक विश्लेषण से पता चला है कि बोर्डुआर इकोरेस और सी2 नस्ल में 400 अंडों से अधिक उर्वरता और 87% से अधिक ईआरआर (%) के साथ कम और अधिक ऊंचाई पर बेहतर प्रदर्शन कर रही हैं। सभी मौसमों में सी2 नस्ल के बाद बोर्डुआर में कोकून पैरामीटर सबसे अधिक देखे गए। मणिपुर के दोनों ऊंचाई वाले क्षेत्रों में वाणिज्यिक एरी कोकून उत्पादन के लिए में बोर्डुआर इकोरेस और सी2 नस्ल का उपयोग किया जा सकता है।

- ओक तसर रेशम पतंगों के संग्रह के लिए उत्तर पूर्व भारत के क्षेत्रों का सर्वेक्षण किया गया था। असम, मेघालय, मणिपुर, मिजोरम और नागालैंड से संग्रह किया गया। ओक तसर मादा रेशम कीटों के लिए अलग-अलग ओविपोजिशन बायोएसेज़ के माध्यम से अंडे देने के लिए प्रेरित करने के लिए उपयुक्त मेजबान पौधों की पहचान की गई।
- ओक तसर रेशमकीट की तीन प्रजातियाँ ए. *प्रोयली* ए. *पेर्नी*, ए. *फ्रिथी* और आरएसआरएस, इंफाल में जीपीबी में नौ विकसित नस्लों, एरी और मूगा रेशमकीट की तीन इको-प्रजातियों का समुचित रखरखाव किया जा रहा है।

प्रौद्योगिकी का स्थानांतरण

- 200 मूगा आदिवासी किसानों को मूगा संस्कृति की उन्नत तकनीकों पर प्रशिक्षित किया गया और उन्हें सभी तकनीकी इनपुट सहायता प्रदान की गई। गोद लिए गए लाभार्थियों के ज्ञान स्तर में 59% की वृद्धि हुई, प्रौद्योगिकी अपनाने में 17.47% की वृद्धि हुई, कोकून उत्पादन में 21.5% की वृद्धि हुई और कुल आय में 79.6% की वृद्धि हुई।
- संस्थान द्वारा तीन वन्य रेशम कृषि मेले, 02 कार्यशालाएँ, 03 प्रदर्शनियाँ, 08 फ़ील्ड दिवस, 23 जागरूकता कार्यक्रम और 23 प्रौद्योगिकी प्रदर्शन कार्यक्रम को सफलतापूर्वक आयोजित किए गए। वर्ष के दौरान इन कार्यक्रमों के माध्यम से लगभग 4257 व्यक्तियों को जागरूक किया गया ।
- कुल 1901 किसानों, अधिकारियों, छात्रों और एनजीओ सदस्यों को पांच अलग-अलग प्रशिक्षण घटकों जैसे किसान कौशल प्रशिक्षण, प्रौद्योगिकी अभिविन्यास कार्यक्रम, पोस्ट कोकून सेक्टर के तहत प्रशिक्षण, सेरीकल्चर संसाधन केंद्र के तहत प्रशिक्षण, राष्ट्रीय बीज अधिनियम और गैर-सीबीटी वित्त पोषित प्रशिक्षण, एसटीईपी के तहत प्रबंधन विकास कार्यक्रम, जागरूकता कार्यक्रम के तहत प्रशिक्षित/कुशल बनाया गया। 97 लाभार्थी किसानों को "**समर्थ**" योजना के तहत कपड़ा क्षेत्रों में भी प्रशिक्षित किया गया।
- काजीरंगा विश्वविद्यालय के10 एम.एस.सी. (रसायन विज्ञान) छात्रों ने अपना शोध प्रबंध कार्य इस संस्थान के वैज्ञानिकों के मार्गदर्शन में पूरा किया, संस्थान की अनुसंधान एवं विकास गतिविधियों से परिचित होने के लिए इस वर्ष के दौरान 1053 छात्रों/किसानों ने संस्थान का दौरा किया और राज्य रेशम विभाग, बिहार के 05 अधिकारियों को केसरू पौधों की खेती की तकनीकें नर्सरी संचालन पर विशेष ध्यान देने के साथ पर प्रशिक्षित किया गया।
- वर्ष के दौरान 09 नई विकसित प्रौद्योगिकियों का ऑन-स्टेशन परीक्षणों के माध्यम से परीक्षण किया गया और ऑन-फार्म परीक्षणों के माध्यम से 12 प्रौद्योगिकियों का परीक्षण मे 485 लाभार्थियों को कवर करते हुए विभिन्न स्थानों पर जागरूक किया गया।
- शिवसागर, जोरहाट, गोलाघाट और डिब्रूगढ़ क्षेत्रों में ब्लॉक वृक्षारोपण के लिए ऑन-फार्म परीक्षणों कार्यक्रम के माध्यम के तहत 15.5 एकड़ के कुल क्षेत्रफल में वृक्षारोपण के साथ ऊपरी और निचले असम में 69 चयनित एरी किसानों को केसेरू एक्सेसेशन (एचएफ005 और एचएफ008) के 6900 पौधे प्रदान किए गए। कुल 100 किलोग्राम केसरू बीज की आपूर्ति डीओएस, मिजोरम को की गई। श्रेष्ठ मेज़बान पौधे को लोकप्रिय बनाने के लिए 37 चयनित एरी किसानों के बीच 5058 बोरपत पौधे भी वितरित किए गए जिसको 11.38 एकड़ भूमि में ब्लॉक वृक्षारोपण किया जा सकता है। 87 किसानों को 125 किलोग्राम अरंडी (एनबीआर) बीज वितरित किए गए।
- ओक तसर उत्पादन में उजी मक्खी के नियंत्रण के लिए आईपीएम प्रौद्योगिकी के सत्यापन के लिए अगस्त-सितंबर 2022 में ओएसटी आयोजित किया गया था। आईपीएम के साथ उजी संक्रमण का प्रतिशत 6-9% दर्ज किया गया था, जबकि नियंत्रण में यह 16-20% था।
- कालियाबाड़ी में वाष्पशील मिश्रणों का परीक्षण किया गया जिसमे बीज फसल के दौरान नियंत्रण की तुलना में मूगा रेशमकीट के अंडे देने में 9.3% का सुधार हुआ।

- ऊपरी, निचले और मध्य असम क्षेत्रों में मूगा कीटों के नियंत्रण के लिए एलईडी लाइट ट्रैप के ओएफटी ने मूगा रेशमकीट के साथ-साथ इसके मेजबान पौधों में कीट संक्रमण को 20-30% तक कम कर दिया।
- 30 किसानों द्वारा किये गये परीक्षण में मूगा रेशमकीट बीज उत्पादन के लिए आईटीके और आधुनिक प्रौद्योगिकी के एकीकृत अभ्यास के ओएफटी ने सामान्य अभ्यास की तुलना में मूगा रेशमकीट की बीजोत्पादन में 16.6% की उल्लेखनीय वृद्धि की।
- भोदिया (सितंबर-अक्टूबर), कोटिया (अक्टूबर-नवंबर) और जरूआ (दिसंबर-जनवरी) फसलों के दौरान 25 किसानों के खेतों में उच्च मूगा कोकून उपज के लिए आईटीके और आधुनिक प्रौद्योगिकी के एकीकृत अभ्यास के ओएफटी ने औसत कोकून उपज में मौजूदा प्रथा से 16.3% अधिक की वृद्धि की।
- वर्ष के दौरान सीएमईआर एंड टीआई और इसकी नेस्टेड इकाइयों के वैज्ञानिकों ने राष्ट्रीय और अंतर्राष्ट्रीय पत्रिकाओं में 26 शोध/समीक्षा पत्र, 10 पुस्तकें/पुस्तक अध्याय और मैनुअल, 09 विस्तार पुस्तिकाएं/बुलेटिन और 41 सार प्रकाशित किए।

संस्थान का प्रकाशन

- वर्ष के दौरान केन्द्रीय मूगा एरी अनुसंधान एवं प्रशिक्षण संस्थान और इसकी नेस्टेड इकाइयों के वैज्ञानिकों ने राष्ट्रीय और अंतर्राष्ट्रीय पत्रिकाओं में 26 शोध/समीक्षा पत्र, 10 पुस्तकें/पुस्तक अध्याय और मैनुअल, 09 विस्तार पुस्तिकाएं/बुलेटिन और 41 सार प्रकाशित किए।

अन्य उपलब्धियाँ

- डॉ. अरुण कुमार, सदस्य, विशेषज्ञ समिति, आरसीजीएम (डीबीटी) और सदस्य वैज्ञानिक सलाहकार बोर्ड, इंटरनेशनल कांग्रेस ऑफ एंटोमोलॉजी।
- डॉ. अमित कुमार, डॉ. अरुण कुमार और डॉ. आफताब ए. शबनम, अतिथि संपादक- प्राकृतिक फाइबर अनुसंधान में हालिया प्रगति पर विशेष अंक (जर्नल ऑफ एप्लाइड बायोलॉजी एंड बायोटेक्नोलॉजी)
- डॉ. टी. जेम्स कीसा, सदस्य स्नातक अध्ययन बोर्ड, मणिपुर विश्वविद्यालय
- डॉ. अरुण कुमार - संपादक एवं सदस्य वैज्ञानिक, इंटर. जे. जंगली रेशमकीट और रेशम
- डॉ. अमित कुमार, संपादक, भूमि (IF 3.3); फ्रंट. पर्यावरण. विज्ञान. (IF 4.5)
- डॉ. अमित कुमार, संपादक, माइक्रोबियल टेक्नोलॉजी फॉर क्लाइमेट रेजिलिएंट एग्रीकल्चर (स्प्रिंगर, स्विट्जरलैंड)

HIGHLIGHTS OF ACHIEVEMENTS (2022-23)

Central Muga Eri Research &Training Institute, Lahdoigarh, Jorhat with a network of RSRS, Boko, RSRS, Imphal and RECs located at Lakhimpur (Assam), 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 2022-23 is presented below:

Host Plant Improvement, Production and Protection

- Castor gene pool was enriched with 05 more perennial accessions collected from NE region. 17 accessions in castor germplasm bank were characterized based on seed characteristics, morpho-metric, biochemical and bioassay traits (Total 92 traits). A descriptor-cum-catalogue on characterization castor germplasm was published and released during Vanya Symposium held at Ranchi in Oct. 2022.
- Potential castor accessions were utilized in hybridization programme for development of perennial castor variety with improved characteristics. 12 perennial lines were selected in F_2 generation and plant to row progeny raised in F_3 generation.
- During the year 14,968 seedlings of Muga and Eri superior host plants were supplied to 156 beneficiaries. This has supported to augment plantation of superior host plant accessions at farmers' fields about 34 acres.
- Nutritional status of vanya sericulture top soils in Lakhimpur (Assam) was assessed and spatial distribution maps were prepared to depict the availability of micro and macro nutrients. Ameliorative measures were suggested to enrich the nutrient deficient soils for harvesting quality Muga and Eri cocoons.
- Comparative study of Muga silkworm rearing and grainage performance in different seasons on four food plants viz., Som (*Persea bombycina*), Soalu (*Litsea monopetala*), Dighloti (*Litsea salicifolia*) and Mejankori (*Litsea cubeba*) revealed the superiority of Som + Soalu (vice versa), followed by combination with Dighloti.
- Seri-climatic manual of Muga growing districts of Assam was prepared and published. This will serve as a reference for the students, seri-entrepreneurs, scientists and policy makers of Assam and will help in quality decision making in respect to changing environmental scenarios for promotion of muga culture.
- Treatment of elevated CO_2 and temperature on muga silkworm and its major host plant som (*Persea bombycina*) under controlled conditions decreased the larval and cocoon weight and impacted the biochemical constituents of the leaf indicating the adverse impact of changing environment on muga culture.
- Process for preparing standalone and blended mulberry beverage has been standardized. 3000 samples of each process were field evaluated for obtaining customer feedback. This will lead to commercialization of standalone and blended mulberry beverages.

Silkworm Improvement, Production and Protection

- Identified the existence of summer aestivation in muga silkworm (*Antheraea assamensis*), wherein wild muga undergoes resting/sleep during summer season (Jul-Sep) to overcome unfavourable weather conditions during summer. The finding will lead to development of aestivating muga lines to avoid rearing during hot summers.
- Comprehensive characterization of the gut microbiome of muga and eri silkworm was

carried out and observed that keystone microbial species populate the gut depending upon the host plant species. Screening for lignocellulose degradation has led to isolation of enzymatically potential microbes capable of degrading xylan. This has led to characterization of the strain by whole genome sequencing and identification of genetic clusters.

- The web accessible database "Vanya Silkbase" has been developed, which will help vanya silkworm researchers in mining genes of interest in wild silkworm species.
- Complete elimination of pebrine spores was achieved with 4% Nirmool treatment in comparison to 2% NaOCl. Therefore, Nirmool can be used as an alternative to NaOCl for egg treatment in grainage and also can be used for field application in muga rearing.
- Asthra and bleaching powder-based disinfection schedule and hygiene maintenance in eri silkworm rearing was developed and demonstrated in the field.
- A new method for identification of pebrine (*Nosema sp*. Aa1) detection using Artificial Intelligence and Machine learning models was developed. Development of mobile based application for real time identification and quantification is in progress.
- Under eri silkworm improvement programme, 100% homogeneity was achieved in 04 ecorace (6 strains). Crossing of pureline parents was carried out in 10x10 diallel fashion. Borduar Yellow Plane (BYP) was found to the best general combiner. Based on the SCA and reciprocal effect, three hybrids C2 x B YP, B YP X T GBP and G YP X T GBP have been shortlisted for limited trials at the Institute level.
- Eri chawki rearing technique was standardized and several demonstrations and field testing of eri chawki rearing was carried out in different regions of Assam, Nagaland and Gujarat. More than 20% increase in cocoon yield was recorded over conventional rearing.
- A new cocoon cooking formulation that can facilitate efficient and uniform cooking of muga cocoons was developed and tested for its efficacy on reeling performance. The trial results indicated reduction in breakages (upto 35-40%) during the reeling process and improvement in raw silk recovery (by 8-10%) besides retaining its luster and physical properties. The cooking duration was reduced by almost 60% and the formulation was found suitable for cooking both Muga and Eri cocoons. The cooking solution can be reused effectively for 2-3 times thereby supporting the conservation of materials involved.
- Nutrients composition and bioactive compounds in both eri and muga pupae were evaluated and essential amino acids, fatty acids, sugars, flavonoids, phenolic acids and vitamin contents were analyzed. The heavy metals and anti-nutrients in both eri and muga pupae were found below harmful level to human beings as per WHO standards.
- Identified 7 bacterial species in the spent muga pupae by DNA sequencing. The microbial species *Viz., Exiguobacterium undae, Exiguobacterium antarcticum, Pantoea vagans, Exiguobacterium sp., Bacillus thuringiensis, Staphylococcus capitis* were found in muga spent pupae.
- Eri pupal snacks prepared by CFTRI were tested through sensory evaluation by the panelists of traditional area (Assam). Preserved eri pupae by using natural preservatives at different temperatures were tested through sensory evaluation and up to 4 days' pupae preserved at low temperature (2-8^{o}C) is accepted by the panelists.
- Standardized the rearing and grainage technologies of *Antheraea frithi* for commercial adoption. Rearing performance was observed better by feeding *Lithocarpus dealbata* leaves than *Quercus serrata* and *Quercus griffithii* during spring (April-May) and autumn (September-October) seasons in Manipur. Economic parameters such as cocoons per dfl (42 nos.), cocoon weight (4.50g), shell weight (0.52g) and shell ratio (11.55%) were recorded higher during spring crop when worms fed with *L. dealbata* foliage

- Different eri silkworm ecoraces, strains and breeds suitable for varied agro-climatic conditions of Manipur were maintained. Comparative analysis has revealed that ecorace Borduar and C2 breed are better performing in low as well as high altitudes with fecundity above 400 eggs and ERR% above 87%. Cocoon parameters were also observed highest in Borduar followed by C2 breed in all the seasons. These can be exploited for commercial eri cocoon production in both the altitudes of Manipur.
- North east region was surveyed for collection of oak tasar silk moths. Collections were made from Assam. Meghalaya, Manipur, Mizoram and Nagaland. Suitable host plants were identified to instigate egg laying through different oviposition bioassays for oak tasar female silk moths.
- Three species of Oak tasar silkworm *A. proylei, A. pernyi, A. frithi* and nine evolved breeds, three eco-races of eri and muga silkworm are being maintained in GPB at RSRS, Imphal.

TRANSFER OF TECHNOLOGY

- 200 muga tribal farmers were trained on improved technologies of muga culture and were provided all technological input support. The knowledge level of the adopted beneficiaries increased by 59%, technology adoption increased by 17.47%, cocoon production increased by 21.5% and overall income increased by 79.6%.
- Three Vanya Resham Krishi melas, 02 workshops, 03 exhibitions, 08 Field Days, 23 awareness programmes and 23 technology demonstration programmes were organized by the Institute. About 4257 persons were sensitized through these programmes during the year.
- A total of 1901 nos. of farmers, officials, students and NGO members were trained/up-skilled under five different training components like 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. 97 beneficiary farmers were also trained in Textile Sectors under "**SAMARTH**" scheme
- 10 M.Sc. (Chemistry) students of Kazhiranga University were supervised by the scientists of CMER&TI and completed their dissertation work, 1053 students/farmers visited the Institute during the year to get acquainted with R&D activities of the Institute and 05 officials from DOS, Bihar were trained on host plant cultivation techniques with special focus on Kesseru nursery operations.
- During the year 09 newly developed technologies were test verified through on-station trials and 12 technologies were tested through on-farm trials at different locations covering 485 beneficiaries.
- 6900 seedlings of Kesseru accessions (HF005 and HF008) were supplied to 69 selected Eri farmers for popularization of these superior accessions in upper and lower Assam with a total area plantation of 15.5 acres under TOT programme. 5058 Borpat seedlings were also distributed among 37 selected Eri farmers for raising block plantations in 11.38 acres of land. 125 kg Castor (NBR) seeds were distributed to 87 farmers for raising block plantation in Sivasagar, Jorhat, Golaghat and Dibrugarh areas.100 kg Kesseru seed was supplied to DOS, Mizoram.
- The OST for validation of IPM technology for control of uzi fly in oak tasar culture was conducted in Aug-Sep 2022. Percentage of uzi infestation recorded was 6 -9 % with IPM as against 16-20 % in control.
- Volatile blends were tested at main station and MESSO, Kaliabari. Egg laying of muga silkworm improved by 9.3% as against control during seed crop.

- OFT of LED light traps for control of muga insect pests in upper, lower and middle Assam areas reduced pest infestation by 20-30% in muga silkworm as well as its host plants.
- OFT of Integrated Practice of ITK and Modern Technology for Muga Silkworm Seed production conducted at 30 farmers increased the muga silkworm fecundity significantly by 16.6% over the normal practice.
- OFT of Integrated Practice of ITK and Modern Technology for Higher Muga cocoon yield conducted at 25 farmers' field during late Bhodia (Sep-Oct), Kotia (Oct-Nov) and Jarua (Dec-Jan) crops increased the average cocoon yield by 16.3% over the existing practice.
- During the year Scientists of CMER&TI and its nested units published 26 research/review papers in National and International journals, 10 books/book chapter and manuals, 09 extension booklets/bulletins and 41 abstracts.

Publication of Institute

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Other Achievements

- Dr. Arun Kumar, Member, Expert Committee, RCGM (DBT) & Member Scientific Advisory Board, International Congress of Entomology.
- Dr. Amit Kumar, Dr. Arun Kumar and Dr. Aftab A. Shabnam, Guest Editor- Special issue on Recent Advancements in Natural Fibre Research (Journal of Applied Biology & Biotechnology).
- Dr. T. James Keisa, Member Board of undergraduate studies, Manipur University
- Dr. Arun Kumar – Editor & Member Scientific, Inter. J. Wild Silkmoth and Silk
- Dr. Amit Kumar, Editor, Land (3.3); Front. Environ. Sci. (4.5)
- Dr. Amit Kumar, Editor, Microbial technology for Climate Resilient Agriculture (Springer, Switzerland)

परियोजनाओं की सूची LIST OF R&D PROJECTS

सम्पन्न परियोजनाएं PROJECTS CONCLUDED IN 2022-23:

Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
1	BPP-05014-CN	Standardization of Processing and Production of a Consumable Beverage from Mulberry Leaves and Blending with Green Tea (CSB Funded) Collaboration with TTRA, TOCKLAI/ AAU, Jorhat & RSRS, Jorhat	Mar.,2020 to June, 2022	K. Sathyanarayana M. Chutia, P. Sangannavaer, P. Kumerasen	-
2	MOE-05004-EF	Adoption of improved sustainable technologies of muga culture for elevation of cocoon production in the tribal belt of Assam (DST funded)	Aug., 2019 To July 2022 (Extended upto Feb. 2023)	Vijay N	Dip Kumar Gogoi, (upto Aug. 2021), D. Mech, SAS Rahaman, K Sathyanarayana
3	PIB-05005-SI	Genetic enhancement of Castor (*Ricinus communis* L.) germplasm as a source material for development of productive perennial varieties (CSB funded project)	Oct., 2019 to Sept., 2022	Aftab A. Shabnam-PI	Amit Kumar, D.K. Jigyasu, L. Somen Singh
4	AIB-05006-SI	Breeding of muga silkworms for improved silk quality and disease tolerance (CSB funded project)	Oct.,2019 To Sept.,2022	Arun Kumar K.P.	Mahesh D.S., Manjunath R.N.
5	APR-05007- SI	Standardization of chawki rearing practices for Eri silkworm, *Samia ricini* (Donovan) (CSB funded project)	Oct.,2019 To Sept.,2022 (Extended upto Mar. 2023)	Mahesh D. S.	Arun Kumar K.P., & K. Subadas Singh
6	APR-05008-SI	Standardization of Rearing and Grainage Technologies of	Oct.,2019 To Sept., 2022	L. Somen Singh	S. Subharani Devi

Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
		Antheraea frithi Moore (CSB funded project)			
7	APR-05010-SI	Evaluation of eri silkworm races suitable for different agro-climatic conditions of Manipur (CSB funded project)	Oct., 2019 to Sept., 2022	Y. Debaraj	L.Somen Singh
8	AIT-05011-EF	Molecular investigation into the ligno-cellulolytic system of a few wild silkmoth in North East India (DBT funded project) (Collaboration with NEIST, Jorhat)	Oct., 2019 to Sept., 2022	Arun Kumar	-
9	AIT-05016-MI	Integrating genomic and transcriptomics resources for functional insight into the biology of Muga Silkmoth *Antheraea assamensis*	Jan.,2021 To Dec.,2022	Arun Kumar K.P.	-
10	CFC-5017-MI	Exploration and adoption of novel muga cocoon cooking technology for increasing its reelability and raw silk quality (Collaboration with RSTRS, Guwahati)	Mar.,2021 To Feb.,2023	Manjunath R.N.	D.K. Gogoi, Rajiv K. Munshi
11	MFM-5019-MI	Development of honeycomb mountages and harvesting technology for muga Cocoon production with improved uniformity and raw silk recovery (Collaboration with RSTRS, Guwahati)	Mar.,2021 to Feb.,2023	Manjunath RN	Mahesh D.S, Urmimala Hazarika
Concluded as Co-PI /CI with other Institute					
1	BPS-01013-CN	Utilization and diversification of silkworm pupae products for human &	Sept., 2020 to Aug, 2022 (extended up to March, 2023)	Mahesh D.S.	James Kiesa

Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
		animal consumption and composting.			
2	CYF-7014-MI	Development of 3D woven silk fabrics and their applications (in collaboration with CSTRI, Bangalore) (CSB funded project)	July,2020 To June,2022 (Extended upto Nov. 2022)	H. S. Hambulingappa	Manjunath R.N.

नैरंतरिक परियोजनाएं ON GOING RESEARCH PROJECTS:

Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
1	AIB-05012-SI	Inter and intra-specific hybridization for improvement of eri silkworm, *Samia ricini* Donovan. (CSB funded project)	Mar., 2020 to Feb., 2024	Reeta Luikham	Aftab Ahmad Shabnam
2	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 (upto 30-06-2022)	Aftab A. Shabnam, G. Subrahmanyam, (upto 26-06-2021)
3	ARP-05015-SI	Development of chemical-based control measures for management of pebrine disease in Muga silkworm, *Antheraea asamensis* Helfer	Jan.,2021 to Dec.,2023	Arunkumar KP	-
4	AIB - 05009 SI	Isolation of thermo-tolerant line(s) of oak tasar silkworm *Antheraea proylei* J (CSB funded project)	Oct.,2019 to Sept.,2022 (Extended upto Sept., 2023)	Y. Debaraj	S. Subharani Devi, Arun Kumar
COLLABOTRATIVE PROJECTS					
5	APR-05018-MI	Effect of various host plants separately and in combination on Rearing and grainage performance of Muga silkworm, *Antheraea assamensis* Helfer (Collaboration with MSSO, 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
6	APS-05021-EF	Studies on population diversity and role of host plant volatiles cues for enhancing egg laying in	Jan., 2022 to Dec., 2024	Sinam Subharani Devi	K. M. Vijayakumari

Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
		temperate tasar silk moth (*Antheraea proylei*) (DBT funded project): Collaboration between RSRS, Imphal; CMER&TI, Lahdoigarh; Manipur University and IIHR, Bengaluru)			
7	APS-05020-MI	Commercial egg production technology for eri-culture (Collaboration with EBSF, MESSO, Topatoli)	Feb., 2022 to Jan., 2024	Mahesh D.S.	Arunkumar K.P., Lalita Natrajan
8	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) (collaboration with all nested units of CMER&TI and MESSO)	Feb., 2022 to March, 2024	Dr. D K Jigyasu	Shri Suraj Pal, James T Keisa, Yumnam Debaraj. L. Somen Singh, B.N. Choudhury, SAS Rahman, Diganta Mech, Aftab A Shabnam, Subharani Devi, Arun Kumar KP, Amit Kumar, Subadas Singh, Vijay. N, Mahesh D S, Manjunath R N, Abhishek Singh
Newly initiated projects during the year 2022-2023					
9	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 CMER&TI & MESSO units (CIs).
10	AIT-05024-EF	Advanced level Institutional Biotech Hubs	Mar. 2023 to Feb. 2026	Arun Kumar	Bitupan Das, Reeta

Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
	(DBT funded)	at Central Muga Eri Research and Training Institute, Jorhat, Assam (Phase-II)			Luikham, Mahesh D S
COLLABOTRATIVE PROJECTS AS CoPI/CI with other Institutes:					
11	AIB 08008 MI	Development and evaluation of Eri silkworm (*Samia ricini* Donovan) breeds/ hybrids with improved productivity (SBRL)	Mar 2022 to Feb 2025	Reeta Luikham, PI	Aftab A. Shabnam (CI)

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

रेशमकीट विभाग
SILKWORM DIVISION

CONCLUDED PROJECTS

Project Code: AIB05006SI

Project Title: Breeding of muga-silkworms for improved silk quality and disease tolerance.

Project Period **:** October, 2019 to September, 2022
Funding Agency **:** Central Silk Board, Bengaluru
Total Budget Allocation **:** 18.32 Lakhs
Total Expenditure (During the year) **:** 3.54 Lakhs
Scientist Involved **:** Dr. Arun Kumar K.P., PI
Dr. Mahesh D.S., CI
Dr. Manjunath R.N., CI

Objectives:

1. Selection of better parents by field collection of muga silkmoth samples.
2. Classical breeding studies to select better lines for muga silkmoths.
3. Mass production for limited trials.

Summary of the findings/achievements:

Breeding for incorporating pupal hibernation in cultivated varieties

Diapause / hibernation is an arrested state of development which is pre-programmed that allows animals to save themselves from the harsh environmental conditions. The expression of hibernation behaviour sets in during unfavourable environmental conditions, such as winter, extreme summer, periods of drought and season in which appropriate food is not available. Diapausing insects become highly tolerant to cold, heat, desiccation and starvation.

In muga probably due to continuous selection for non-hibernating trait, pupal hibernation is not observed in cultivated stock. Therefore, the farmers and government agencies have to continuously rear muga silkworms throughout the year even in unfavourable weather conditions. However, this study has observed pupal hibernation in wild muga. The wild muga collections exhibit both winter as well as summer hibernation. The winter hibernation is longer and starts in the month of November and moth emergence starts in April month (Figure 1). The summer hibernation sets in June and the moth emergence starts in October. Harnessing this behaviour for commercial rearing will significantly help in improving the seed availability in muga ecosystem as hibernation will aid in skipping rearing during unfavourable months.

However, the genetic loci linked to this hibernation behaviour is not yet identified and efforts have been made in this project using large scale genotyping and comparative genomics analysis to identify the gene(s) linked to hibernation in muga silkworm. GWAS analysis is not yet complete, which requires more time and efforts to arrive at the loci responsible for hibernation behaviour. Identification and introgression of hibernation linked genes into cultivated stock will go a long way in addressing the problems of rearing in unfavourable seasons in muga ecosystem.

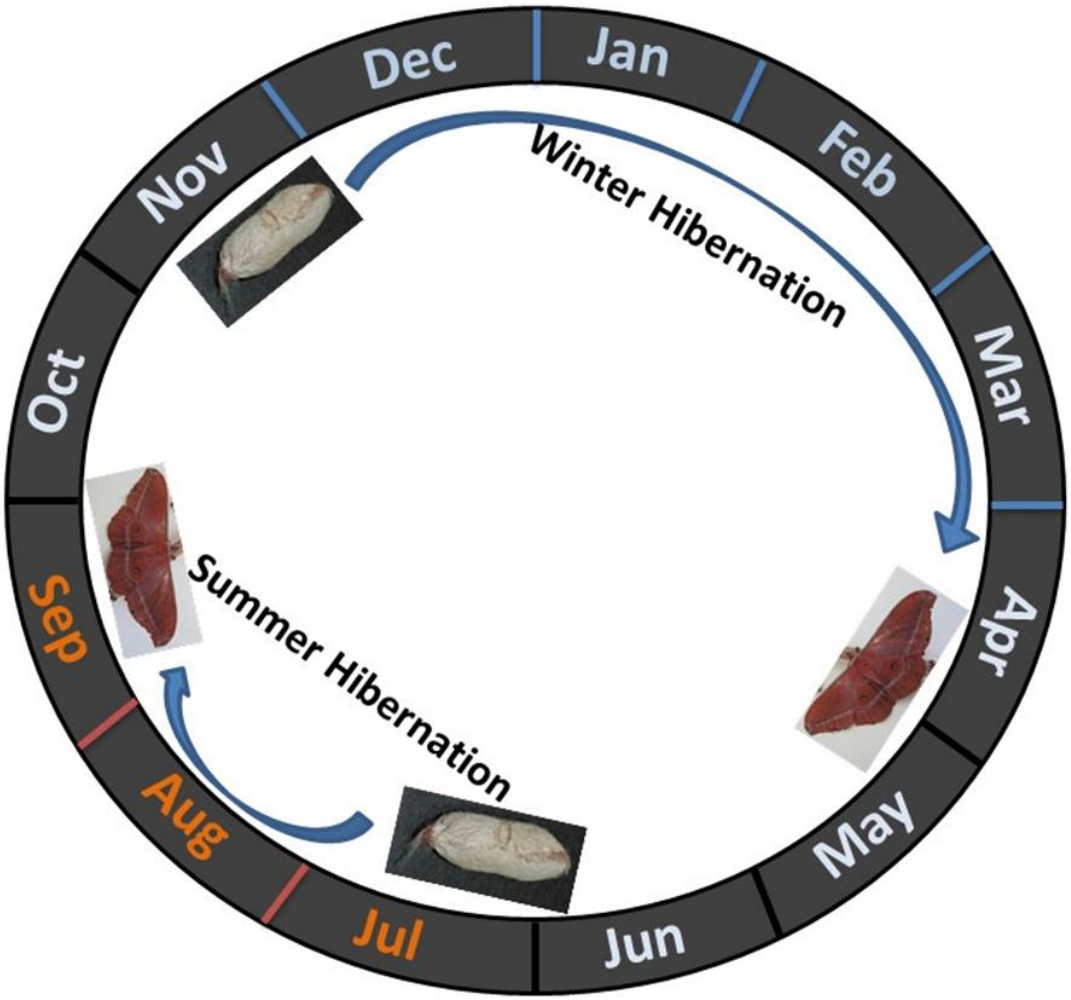


Figure 1: Breeding for incorporating pupal hibernation in cultivated varieties would help avoid rearing of muga in unfavourable seasons.

<u>Project Title: APR05007SI</u>- Standardization of chawki rearing practices for Eri silkworm, *Samia ricini* (Donovan).

Project Period **:** October, 2019 to September, 2022 (extended upto March 2023)
Funding Agency **:** Central Silk Board, Bengaluru
Total Budget Allocation **:** 18.15 Lakhs
Total Expenditure (During the year) **:** 4.95 Lakhs
Scientist Involved **:** Dr. Mahesh D. S, PI
Dr. Arun Kumar K.P, CI
Dr. Kh. Subadas Singh, CI

Objectives:

1. Establishment and management of eri host plant garden for eri chawki rearing.
2. Design and fabrication of Eri silkworm chawki reaing equipment
3. Development of new rearing method and ideal environment for eri chawki rearing.

Summary of the findings / achievements:

- Designed and fabricated a model Eri chawki rearing centre at CMER&TI: Equipped with all the facilities which acts as demonstration unit for the eri rearers in Northeast India. It also acts as a functional eri chawki rearing centre for continuous trials and testing for further improvement and also for studies on economics of eri chawki. The chawki rearing centre helps in continuous production of chawki worms for supply to farmers for popularization at field level. This has been fabricated taking into consideration the harsh weather conditions during summer and winter months by using local indigenous materials Viz., bamboo, thatched roof etc.
- Standardized the economics of eri chawki rearing technology for commercial C2 breed and Borduar ecorace which helps to the development of eri chawki rearing enterprises in different regions of north eastern states and other Eri growing areas.
- Conducted several demonstrations and field testing in different regions of North-eastern India. The cocoon yield from chawki rearing was compared with the conventional method in farmers' field and found to be significantly higher (>20%).
- The significantly increased cocoon yield was recorded in the chawki reared batch due to the successful eri chawki certification system adopted before distribution of the chawki to the farmers.
- For the first time, the highest fresh cocoon yield of 104 Kg per 100 DFLs has been recorded by giving onsite demonstration on eri chawki rearing technology in non-traditional area of Ericulture i.e., Bhadresar village, Sabarkantha district, Gujarat under the farmers skill training and awareness programme. Also created the eri chawki rearing centre facility in coordination with M/S Kalyan foundation, Palanpur, Gujarat.

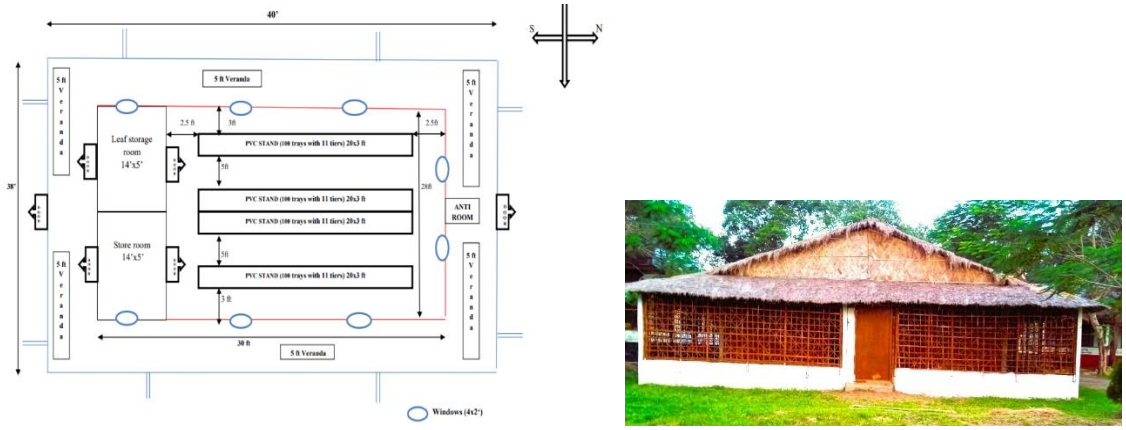


Figure 1: Blue print of a Model Eri Chawki Rearing House (for brushing 5000 DFLs at a time) and Model Eri Chawki Rearing House Designed and Fabricated under this project.

Economics of eri chawki rearing

The economics of Eri chawki rearing plays a pivotal role in the entrepreneurship. Entrepreneurs are driven by the desire for a favourable benefit-cost ratio when considering the adoption of new technologies. Eri silkworm chawki rearing presents itself as a promising and appealing business opportunity for those venturing into sericulture entrepreneurship. The entire chawki rearing process is efficiently completed within just 8 days, allowing entrepreneurs to plan for multiple batches based on their capacity for brushing, thereby ensuring a steady and frequent income stream. This economic viability makes chawki rearing of eri silkworms a compelling

choice for aspiring entrepreneurs in the field of Ericulture. Tables 1 to 4 provide a comprehensive overview of the economic aspects of Eri Chawki rearing for entrepreneurs. These tables offer valuable insights and data that can aid entrepreneurs in making informed decisions and optimizing their ventures in this sector. The information presented within these tables serves as a crucial resource for those looking to engage in Eri Chawki rearing and build a successful entrepreneurial endeavour in this industry.

Sl. No.	Particulars	Details
1	Total area under castor	1 hectare / 2.5 acres
2	Castor variety	NBR-1
3	Spacing	1x1 mtr
4	Chawki leaf yield	6.75 MT / year
5	No. of batches for rearing	18 batches/year to brush 90000 DFLs
6	No. of DFLs reared per batch	5000 DFLs
7	Leaf requirement per 1000 DFLs	75 kg

For a better understanding of the chawki rearing on a commercial scale, one hectare model calculation is given below:

Table 1: Establishment and maintenance (variable) cost of 1 hectare castor chawki garden (1 year)

Sl.No.	Particulars	Cost (Rs.)
1.	Cleaning of land by tractor tilling (8 hr.) @ Rs.800/hour	6,400
2.	Leveling of land by using tractor (2.5hr) @ Rs.1000/hour	2,500
3.	Ridge-furrow 40 mandays @ Rs.300/Manday	12,000
4.	Castor seed cost (6 Kgs) @ 250/Kg	1,500
5.	Castor seed sowing 5 mandays@ Rs.300/Manday	1,500
6.	Farm Yard Manure (30 MT) @ Rs.750/MT	22,500
7.	Fertilizer (NPK-270:120:60 kg/ha/harvest), i.e. Urea @ 600 kg/ha/yr, Single Super Phosphate @ 750 kg/ha/yr and Muriate of Potash @ 100 kg/ha/yr	14,500
8.	FYM and fertilizer application (30+ 15mandays) @ Rs.300/Manday	13,500
9.	Irrigation (96mandays) @ Rs.300/Manday	28,800
10.	Hoeing/weeding 2 times per crop (60 mandays) @ Rs.300/Manday	18,000
11.	Leaf harvest (270 mandays @ 25 kgs leaf per manday)	81,000
12.	Miscellaneous expenditure plant protection/ electricity/ land revenue/ etc.	5,000
13	Imputed cost for owned land	12,000
Total		2,19,200

Table 2: Investment on rearing building and equipment/ year (5000 Dfls capacity in each batch)

Non-recurring cost					
Rearing building/ equipment	**Qty. reqd.**	**Rate (Rs.)**	**Cost (Rs.)**	**Life Span (years)**	**Depreciation (Rs.)**
Rearing house for eri chawki Worms (1520 sq. ft.)	1	263/ sq.ft.	4,00,000	10	40,000
Disinfection tank (10'x 5'x 4')	1	-	15,000	15	1500
Plastic rearing tray (2'x3')	400	540/unit	2,16,000	10	21,600
Bamboo rearing stand	16	1500/unit	24,000	5	4,800
Incubation frames	100	80	8000	15	533
Leaf chopping machine	1	35,000	35,000	20	1,750
Feeding stands	4	250/unit	1,000	5	200
Leaf chopping board	2	500	1,000	5	200
Knife	2	200	400	2	200
Circumferential room heaters	2	19,500	39,000	5	7,800
Humidifier	2	8,000	16,000	5	3,200
Power sprayer with mask	1	20,000	20,000	10	2,000
Bed cleaning nets	400	50	20,000	10	2,000
Air cooler	2	5,000	10,000	5	2,000
Microscope	1	25,000	25,000	5	5,000
Disinfection masks	2	1,000	2,000	5	400
Dust bins	4	1,000	4,000	5	800
Plastic crates	5	1,000	5,000	10	500
Wet & dry thermometer	2	1,000	2,000	5	400
Total cost			8,43,400		94,883

Table 3: Recurring costs for brushing 5000 DFLs per batch & 90000 DFLs/year

Particulars	**Requirement (5000 DFLs)**	**Rate (Rs.)**	**Total cost for 5000 DFLs (Rs.)**	**Requirement (per year)**	**Total Costs for 90000 DFLs (Rs.)**
Bleaching Powder (kg)	5	50	250	90	4,500
Asthra (Kg)	0.2	1000	200	3.60	3,600
Lime (kg)	15	30	450	270	8,100
Paraffin Paper (Bundles) 1 bundle for 2000 DFLs	2.5	300	750	45	13,500
Polythene sheet (Apportioned cost for 18 crops)	90 meters	15	1,350	90 meters	1,350
Mandays required (Average 40Mandays / month)	21	300	6,300	378	1,13,400
Cost of Chawki Leaf	375	32.5	12,187	6750	2,19,200
Cost of Layings	5,000 DFLs	7/DFL	35,000	90,000 DFLs	6,30,000

Electricity Charges	Lumpsum	-	1,400	Lumpsum	25,000
Other Costs (Miscellaneous)	Lumpsum	-	1,000	Lumpsum	5000
Total			57,537	-	10,23,650

Table 4: Overall expenditure required to brush 90,000 DFLs / year / ha

Sl. No.	**Head**	**Amount**
1.	Non-Recurring Cost (A)	94,883
2.	Recurring cost (B)	10,23,650
3.	Total of (A+B)	11,18,533
4.	CRC owners profit margin @ 10 % of total cost (A+B)	1,11,583
5.	Risk factor @ 5 % of recurring cost (B)	51,182
6.	Total Expenditure per annum (Sl. No. 3+4+5)	12,81,298
7.	No. of Dfls brushed per year	90,000
8.	Eri Chawki Rearing cost per 100 dfls (6/7) (Rs.)	1,424
9.	Total income if eri chawki sold @ Rs. 2500 / 100 dfls (Rs.)	22,50,000
10.	Net return (Rs.) (Sl. No. 9-6)	9,68,702
11.	Income/ 100 DFLs(10/7) (Rs.)	1,076
12.	B:C ratio	≈1.75

Note: The major cost of production is labour or manpower charges. If one male and one female member of the family is actively involved in chawki rearing, the labour or manpower cost can be reduced significantly. This further reduces the total cost of production, thereby increasing the profit to the eri chawki entrepreneur.

The application of improved technologies in non-traditional areas is easier than the traditional areas. Recently CMER&TI in co-ordination with Kalyan foundation, Gujarat conducted a eri chawki rearing demonstration and shelf rearing system in Bhadresar village of Sabar Kanta district of Gujarat and the rearing was successful and got 208 kgs of cocoon yield out of 200 dfls reared. Hence, the technologies dissemination is very effectively adopted by the new farmers. Also, for commercialization of ericulture from small scale to industrial level, the introduction of eri chawki rearing technology is very much essential. The rearing observations are depicted in the table 5.

Table 5: Rearing performance of chawki reared batch in Gujarat (Bhadresare village, Sabarkanta district):

Particulars	**Chawki reared batch**
Race	Borduar (350 eggs/DFLs)
Date of Hatching	02.11.2023
Hatching (%)	98 %
Number of worms brushed	68,600
Chawki duration (days)	7 days
Missing larval (%) at 2nd moult	0.75
Larval uniformity at 2nd moult (%)	100
100 larval weight (gms) before second moult	5.93

Disease incidence (%) at chawki stage	0
Late age larval duration (days)	17 days
Spinning duration (hours)	2 days (>90%)
Cocoon yield (Kgs)	208
Cocoon yield by number	65,298
Disease incidence (%)- during late age	0
Number of cocoons per kg	314
ERR (%)	95.18
Single cocoon weight (g)	3.18
Single pupal weight (g)	2.72
Single Shell weight (g)	0.46
Cocoon shell (%)	14.47

Table 6: Two-way ANOVA for each observation recorded at different locations under field testing and demonstration: The analysis of variance (ANOVA) was conducted to investigate the effects of treatments and locations on each observation taken in the chawki and conventionally reared batches. The results of the ANOVA are presented in the below tables:

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Hatching %	Chawki	95	96	97	95	95	95	96	98	95.87	Treatment (1)	1788.91	424.177	9.2E-45**
	Conventional	88.2	91.20	89.1	88.70	88.20	90.40	89.5	87.7	89.12	Location (7)	9.67054	2.29303	0.030*
											TXL(7)	16.2777	3.85968	0.0007**

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Missing larval (%)	Chawki	0.56	0.63	0.17	0.56	0.56	0.41	0.52	0.48	0.47	Treatment(1)	1486.449	1340.402	7.84E-75**
	Conventional	4.96	8.24	7.52	6.35	5.55	7.00	7.25	5.76	6.59	Location (7)	5.919566	5.337955	1.89E-05**
											TXL(7)	6.704487	6.045756	3.41E-06**

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Larval uniformity (%)	Chawki	98	99.2	99.5	97.63	97.63	98.3	98.6	99.12	98.50	Treatment (1)	78218.55	7211.126	6.8E-125**
	Conventional	56.48	49.61	60.60	55.47	53.54	51.59	53.16	53.84	54.29	Location (7)	60.69424	5.595524	1.01E-05**
											TXL(7)	55.70508	5.135563	3.09E-05**

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Disease incidence (%)	Chawki	0.05	0.03	0.09	0.07	0.07	0.02	0.08	0.06	0.059	Treatment (1)	1046.682	1852.571	4.17E-84**
	Conventional	5.46	4.24	4.39	4.57	6.11	4.52	4.91	5.40	4.95	Location (7)	4.613543	8.165721	2.33E-08**
											TXL(7)	4.456626	7.887985	4.41E-08**

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Single cocoon weight (g)	Chawki	3.08	3.01	3.00	2.98	2.94	3.04	3.12	3.21	3.05	Treatment (1)	3.915631	402.6327	1.5E-43**
	Conventional	2.73	2.74	2.70	2.75	2.74	2.77	2.70	2.72	2.73	Location (7)	0.02534	2.605628	0.01462*
											TXL(7)	0.055111	5.666862	8.51E-06**

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Single shell weight (g)	Chawki	0.50	0.47	0.46	0.47	0.43	0.49	0.5	0.52	0.48	Treatment (1)	0.529	881.6667	2.91E-63**
	Conventional	0.37	0.39	0.38	0.37	0.37	0.36	0.35	0.35	0.37	Location (7)	0.003099	5.164286	2.89E-05**
											TXL(7)	0.0075	12.5	1.86E-12**

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Single pupal weight (g)	Chawki	2.58	2.53	2.54	2.50	2.50	2.55	2.59	2.68	2.56	Treatment (1)	1.566181	162.8317	2.01E-25**
	Conventional	2.36	2.35	2.32	2.37	2.36	2.40	2.34	2.35	2.36	Location (7)	0.014758	1.534326	0.160156 NS
											TXL(7)	0.025533	2.654649	0.01302*

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Cocoon shell %	Chawki	16.27	15.77	15.34	15.95	14.86	15.93	16.86	16.28	15.91	Treatment (1)	226.8326	270.5962	7.02E-35**
	Conventional	13.64	14.35	13.92	13.48	13.54	13.24	13.21	13.01	13.54	Location (7)	1.712215	2.042559	0.053628*
											TXL(7)	3.730118	4.449782	0.000166**

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Cocoon yield (kg/100 dfls)	Chawki	92.88	91.50	91.86	87.64	87.09	93.53	95.19	99.55	92.41	Treatment (1)	27426.54	1971.929	6.36E-86**
	Conventional	69.12	67.40	64.79	66.73	64.73	68.20	68.47	68.45	67.23	Location (7)	161.0563	11.57972	1.27E-11**
											TXL(7)	102.8768	7.396694	1.38E-07**

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Pupal yield (kg/100 dfl)	Chawki	77.78	77.07	77.76	73.65	74.16	78.63	79.13	77.77	76.99	Treatment (1)	15153.58	1257.336	4.97E-73**
	Conventional	59.69	57.73	55.79	57.74	55.96	59.17	59.42	59.62	58.14	Location (7)	85.97991	7.134001	2.56E-07**
											TXL(7)	27.472	2.279431	0.031297*

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Shell yield (kg/100 dfl)	Chawki	15.10	14.43	14.10	13.98	12.93	14.90	16.05	15.10	14.57	Treatment (1)	1251.584	2168.862	1.04E-88**
	Conventional	9.43	9.67	8.99	9.00	8.78	9.02	9.05	9.43	9.17	Location (7)	6.7275	11.65804	1.07E-11**
											TXL(7)	5.744227	9.954132	4.18E-10**

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Profit from pupa (Rs.)	Chawki	31111.71	30827.17	31102.54	29461.79	29664.7	31453.6	31654.87	31111.71	30798.51	Treatment(1)	2.42E+09	1257.336	4.97E-73**
	Conventional	23876.98	23093.52	22316.73	23094.38	22382.3	23671.4	23770.47	23876.98	23260.35	Location (7)	13756786	7.133998	2.56E-07**
											TXL(7)	4395519	2.279429	0.031297*

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Profit from shell (Rs.)	Chawki	10567	10101.74	9871.89	9786.38	9048.69	10431.1	11238.34	10567.03	10201.52	Treatment(1)	6.13E+08	2168.861	1.04E-88**
	Conventional	6599.88	6766.827	6299.71	6300.45	6412.95	6314.92	6333.26	6599.88	6453.49	Location (7)	3296474	11.65803	1.07E-11**
											TXL(7)	2814669	9.95412	4.18E-10**

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Gross profit (Rs.)	Chawki	41678.74	40928.91	40974.43	39248.17	38713.3	41884.7	42893.21	41678.74	41000.03	Treatment(1)	5.48E+09	2130.63	3.47E-88**
	Conventional	30476.86	29860.35	28616.44	29394.83	28525.2	29986.3	30101.73	30476.86	29679.82	Location (7)	29108015	11.32416	2.17E-11**
											TXL(7)	11468842	4.461828	0.000161**

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
Cocoon yield by number / 100 dfls	Chawki	30138.4	30385.9	30560.9	29438.6	29657.1	30731.7	30529.2	30138.4	30197.53	Treatment(1)	1.29E+09	1803.581	2.49E-83**
	Conventional	25259.70	24568.1	24007.1	24300.30	23633.7	24596.2	25342.4	25259.70	24620.90	Location (7)	5545140	7.767142	5.83E-08**
											TXL(7)	1633564	2.288152	0.030675**

Observation	Rearing batch	Locations								Overall mean	Source of variation	Mean sum of square	F value	P value
		Dhemaji	Borpatar	Chungthia	Golaghat	Udalguri	Jaljori	Mariani	Jorhat					
ERR %	Chawki	90.64	90.43	90.01738	88.54	89.19	92.43	90.86	90.64	90.34	Treatment (1)	4849.789	694.596	5.87E-57**
	Conventional	79.31	79.76	79.75	78.01	78.52	78.96	78.70	79.30	79.03	Location (7)	16.01666	2.293936	0.030269**
											TXL(7)	8.936611	1.279918	0.264265**

5% level of significance **1% level of significance

It's noteworthy that the reported F-values and p-values in the ANOVA table reflect the strength of evidence against the null hypothesis. The small p-values observed in this analysis indicate strong evidence to reject the null hypotheses for the effects of treatment, location, and their interaction. Hence, the outcomes of the ANOVA analysis indicate that both the rearing methods (chawki and conventional) significantly affect the performance of eri silkworm rearing.

Figure 3: Distribution of the eri chawki worms to the self-help group (eri farmers) at SRC, Bokakhat of Golaghat district and Demonstration of brushing techniques for newly hatched worms at Gujarat


Figure 4: Uniformity in eri chawki worms and Distribution of eri chawki worms to the farmers of Kalyan foundation after chawki certification at Gujarat

<u>Project Code: CFC 5017 MI</u>

Project Title: Exploration and adoption of novel solvent based muga cocoon cooking technology for increasing its reelability and raw silk quality.

Project Period : March 2021 to Feb 2023
Funding Agency : Central Silk Board, Bengaluru
Total Budget Allocation : 18.23 lakhs
Total Expenditure : 10.65 lakhs
(During the year)
Scientist Involved : Dr. Manjunath R. N., PI
Dr. D.K. Gogoi, CI
Dr. R.K. Munshi, Co-PI

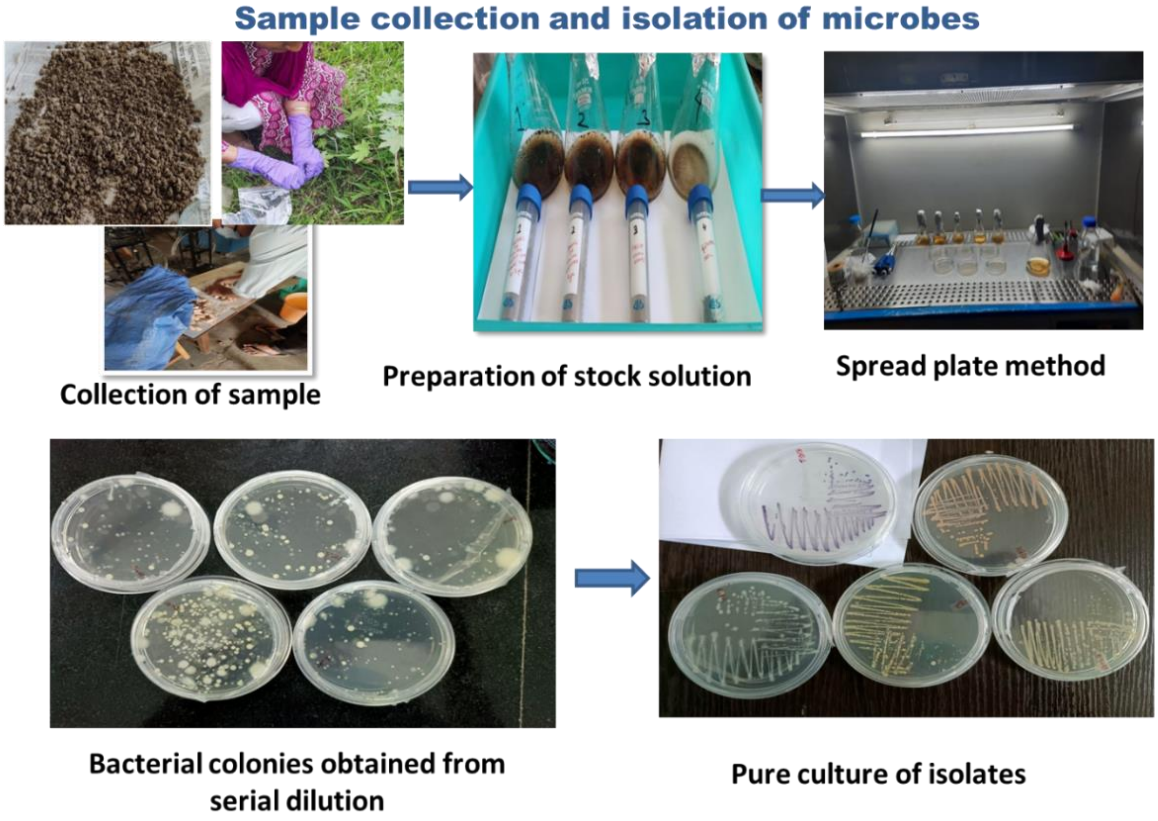
Objectives:

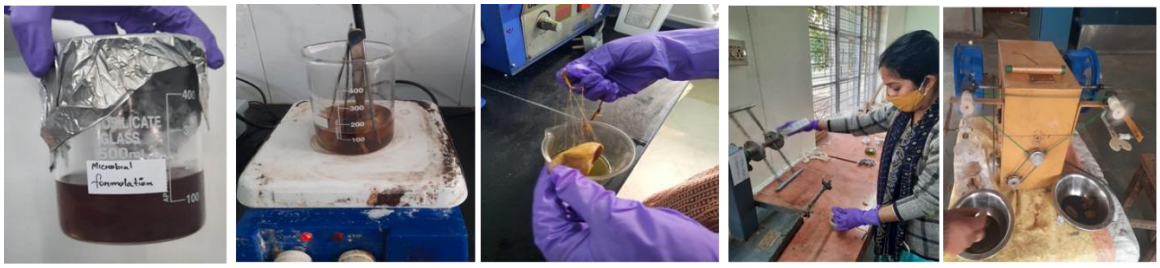
1. To study the efficacy of enzymatic and non-enzymatic approaches in muga cocoon cooking/ softening.
2. To develop a new solvent based cocoon cooking technique to improve the reelability & raw silk quality in muga cocoons dried under different techniques.
3. To carry out large scale Multi-location trials at CSB and DoS reeling units for validating the efficacy of the newly developed cooking method.

Summary of the findings/achievements:

Enzymatic approach

- Bacteria sourced from various potential outlets were screened for lipase and protease activity. One isolate (RSH1) displayed lipase activity, while five isolates exhibited positive protease activity. The isolates' total protein content and enzyme activity at different temperatures were assessed.
- The impact of temperature, pH, and fermentation time on enzyme activity was explored, identifying optimal conditions for protease activity at 35°C and pH 7. Quantitative protease assays validated the enzyme's efficacy.
- RSH1's enzyme was utilized for cocoon degumming and resultant Reeling trials with a microbial consortium demonstrated promising degumming efficiency. An optimization study pinpointed the most effective time and temperature combination for degumming—optimal conditions were observed at 35°C, pH 7.5, and a soaking duration of 30-40 minutes.
- This comprehensive enzymatic approach for muga cocoon degumming yielded positive outcomes in terms of enzyme production, degumming efficiency, and process parameter optimization.
- The resultant enzyme was submitted to the National Collection of Microorganisms (NCMR) with accession number MCC 5323, ensuring accessibility for the scientific community and the public.





Effect of Soaking duration & Temperature for deflossing & reeling

Temp (°C)	0.5hr	1 hr	2hr	3hr	4hr	5hr	6hr
25				-	-	-	-
30			-	-	-	-	-
35			-	-	-	-	-
40				-	-	-	-
45							

Not deflossable Partially defloss Fully defloss

#	Time	Reelability
1	20 min	~ 38.52 %
2	25 min	~ 44.62 %
3	30 min	~ 48.45 %
4	35 min	~ 53.00 %
5	40 min	~ 58.50 %

Reeled Silk

- Temperature : 30-35°C
- pH : 7.5
- Soaking time : 30-40 mins

Figure: Optimization of the treatment conditions through Reeling trials

Non-enzymatic approach

- An innovative cooking formulation has been created, ensuring swift, efficient, and uniform cocoon cooking without compromising raw silk quality (strength & Lustre). Comparative analysis of various cooking methods on muga cocoons yielded promising results.
- With the new formulation, cooking time decreased significantly to one third of the actual duration followed in traditional soda-based techniques. This led to a noteworthy 25-30% reduction in yarn breaks during the reeling process, enhancing cocoon reelability and Raw silk recovery % by around 10-12%.
- The cooking liquor's reusability for 3-4 cycles contributes to the eco-friendly and cost-effective nature of the cooking technique.
- The positive impact of this formulation on muga reeling is evident in improved reelability and simplified cooking, underscores its potential in the sector.

Figure: Luster retention in silk reeled from (a) Soda based & (b) New formulation

Figure: The demonstration cum validation trials were conducted on both bhir and MRTM based reeling techniques

Project Code: MFM 5019 MI

Project Title: Development of honey comb mountages and harvesting technology for Muga cocoon production with improved uniformity and raw silk recovery

Project Period : March 2021 to Feb 2023
Funding Agency : Central Silk Board, Bengaluru
Total Budget Allocation : 10.63 lakhs
Total Expenditure : 5.50 lakhs
(During the year)
Scientist Involved : Dr. Manjunath R.N., PI
Dr. Mahesh D.S., CI
Dr. Lopamudra Guha, MESSO Guwahati, CI

Objectives:

1. Fabrication of honeycomb mountages and suitable harvesting technology for uniform muga cocoon production.
2. Impact assessment of honeycomb mountages on cocoon production, cocoon characteristics and reeling performances.
3. To conduct on-station feasibility trials of the mountages at CSB/DoS units for prototype test verification

Summary of the findings/achievements:

An attempt was made to design and fabricate a novel mountage type in the form of Honeycomb structure aimed to improve cocoon quality and cocooning efficiency in muga cocoons. The following are the brief details on the execution of the project

- Prototype Development: Morphological assessment and cell dimension analysis led to the creation of honeycomb mountages. Initial Pilot trials in mountages made from laminate sheets demonstrated higher cocooning efficiency (90-95%) compared to traditional setups (85-88%), resulting in cleaner, uniform cocoons.
- Harvesting Challenge: Despite improved efficiency, cocoon harvesting posed a time-consuming and labor-intensive challenge.
- Modification for Harvesting: To address the challenge, silkworm placement orientation was modified, and the constructional architecture was altered and different materials were tried out. Initially, aluminum/sheet material were tired but eventually Fiber-reinforced polymer (FRP) sheets were introduced as a more practical alternative.
- Cocooning trials: The resulting cocooning trials achieved good cocooning efficiency and Cocoon reeling performance saw a notable improvement of approximately 7-9% compared to traditional methods (Jali & Box-type mountages) besides easing the mounting and harvesting operations.
- Additional Attributes:
  Efficient Space Utilization: Compact design for maximum space efficiency.
  Durability: FRP material offers longevity robustness & withstands high temperatures.
  Streamlined Processing: can be provisioned for direct transitioning to stifling and cooking, eliminating intermediate harvesting steps.

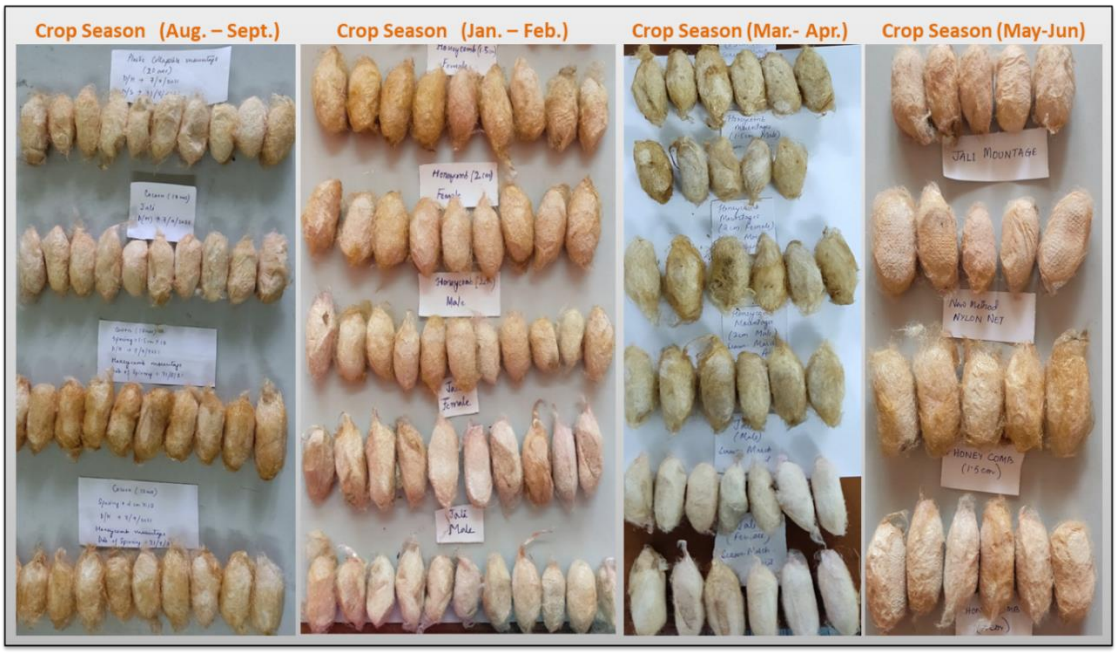


Figure: Seasons-wise cocoons harvested from Jali, Box-type and Honeycomb mountages

Figure: Layer-by-layer stacking of FRP sheets to arrive at the Honeycomb structure

ONGOING PROJECTS

Project Code: AIB-05012-SI

Project Title: Inter and intra-specific hybridization for improvement of Eri silkworm, *Samia ricini* Donovan.

Project Period : March, 2020 to February, 2024
Funding Agency : Central Silk Board, Bengaluru
Total Budget Allocation : Rs. 23.15 Lakhs
Total Expenditure (During the year) : Rs. 4.65 lakhs
Scientist Involved : Dr. Reeta Luikham, PI
Dr. Aftab Ahmad Shabnam, CI

Objectives:

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

Summary of the findings / achievements:

During the presentation at 40th RAC meeting, the house committee suggested to continue a) selection of pure line strains based on larval colour and markings till 100% homogeneity of the population is achieved. b) Selection of pureline parents for crossing should include top as well low ranking strains. c) Possible cross combinations should be carried out accordingly. The selfed rearing was continued for 8th and 9th generation and the rearing performance was recorded. 100% homogeneity of the population was achieved in F9 generation.

Table - 1: Analysis of variance for combining ability in a 10x 10 diallel crosses.

Source	df	Fecundity (Nos.)	Hatching (%)	Larval wt. (g)	ERR (%)	Cocoon wt. (g)	Shell wt. (g)	Shell ratio (%)
GCA	9	99,466.04*	1,458.75**	0.88	9,983.66**	0.87	0.14*	62.27*
SCA	45	208294.03**	2,565.61*	2.81	30,134.54**	1.52**	0.28**	136.88**
Reciprocal	45	183581.91**	1,393.19**	3.501	15,132.69*	1.25	0.21	111.22**
Error	198	48,014.64	541.72	7.61	4,858.80	1.24	0.07	98.15
GCA/ SCA ratio		0.477527	0.57	0.31	0.33	0.57	0.48	0.45

The crossing of pureline parents including top as well as low ranking strains was done in 10x10 diallel fashion to get 100 cross combinations. Analysis of variance for combining ability for seven traits i.e. fecundity, hatching, larval weight, ERR, cocoon weight, shell weight and shell ratio showed significant GCA variance in five traits. Similarly, significant SCA variance were observed in six traits fecundity, hatching, ERR, cocoon weight, shell weight and shell ratio. The significant of both GCA and SCA variance in most of the traits showed that both additive and non-additive components are important for the expression of these traits (Table-1).

Table - 2: General Combining Ability effects in pureline of eri silkworm.

Parents	Fecundity (Nos.)	Hatching (%)	Larval wt. (g)	ERR (%)	Cocoon wt. (g)	Shell wt. (g)	Shell ratio (%)
BYP	28.65**	1.96**	0.03	8.17**	0.08**	0.035**	0.68**
T GBP	6.89**	0.83**	0.02	2.33*	1.39**	0.001	1.11**
C2 breed	7.99**	1.86**	0.04	0.97	0.03**	0.008**	0.091
B GBP	6.71**	0.88**	0.01	1.86**	0.09	0.007**	0.11
T GBS	2.82	1.02**	0.02	2.87**	-0.02	0.006**	0.27**
B YZ	-13.47	-3.31	-0.04	-6.02	-0.04	-0.02	-0.44
B GBZ	-8.20	-0.85	-0.01	-1.87	-0.03	-0.007	-0.09
T YS	-6.87	-0.51	0.03	-0.30	-0.02	-0.002	-0.05
KYP	-20.45	-1.56	-0.09	-6.18	-0.05	-0.021	-0.44
GYP	1.93	-0.31	0.01	-1.82	0.02	-0.006	-0.23

Table -3: SCA effects of selected crosses in 10X10 diallel crosses.

Crosses	Fecundity (Nos.)	Hatching (%)	Larval wt. (g)	ERR (%)	Cocoon wt. (g)	Shell wt. (g)	Shell ratio (%)
C2 breed x B YP	7.91**	1.93	2.72**	4.56**	4.34**	9.43**	5.21**
B YP x T GBP	7.58**	6.23**	1.25	4.80**	3.10**	8.14**	6.85**
B YP x T GBS	7.32**	4.44**	-0.31	4.13**	3.00**	2.14	1.72
B GBP x T GBS	1.98	4.18**	1.75	4.37*	2.45*	2.82	4.37**
B YZ x B GBZ	1.16	1.77	0.65	2.95**	1.69	6.57**	3.70**
B YP x B GBZ	5.48**	1.83	0.08	4.49**	2.69**	3.00	2.08
G YP x T GBP	1.65	-2.42	1.33	0.78	2.34**	6.86**	3.45**
G YP x B GBP	1.49	2.11*	1.01	1.28	1.34	4.86**	3.15**
T GBP x B GBZ	3.35**	1.86	-0.57	1.38	1.97	4.00*	2.37*
B GBZ x T YS	3.51**	0.94	0.88	4.05**	2.24*	1.57	0.23
C2 x T GBP	0.56	0.56	0.82	-0.34	-0.55	2.29*	2.32*
C2 x T GBS	1.00	0.45	1.04	1.90	2.93**	2.43*	0.43
G YP x TYS	2.80**	5.40**	-0.64	-0.06	0.93	1.14	0.43
B GBP x B YZ	2.88**	-3.68	-0.79	0.87	2.24*	0.86	-0.35
T YS x T GBS	1.61	2.45*	-0.60	0.96	1.55	1.86	0.73
T GBP x B GBP	0.89	2.54*	0.24	-0.90	-0.97	0.14	0.72

General Combining Ability (GCA) effects for 10 pureline of Eri silkworm for seven traits i,e., fecundity, hatching, larval weight, ERR, cocoon weight, shell weight and shell ratio

were analysed (Table-2). It was observed that BYP showed positive and high significant GCA effects for six traits. TGBP showed significant GCA effects for five traits and C2 breed, BGBP &TGBS showed significant GCA effects in four traits. Among these 10 pureline parents, BYP showed the best general combiner as it showed significant effects for six traits.

Specific Combining Ability (SCA) effects were analysed for seven traits in 45 forward cross combination, out of which selected 16 cross showing positive and significant SCA effects in one or more traits (Table-3). It is observed that C2 breed x BYP and BYP x TGBP recorded significant effects in six traits. These two cross combinations are selected as a hybrid for limited trials at the Institute level.

The analysis of reciprocal effects for seven traits in 45 reversed cross combination, out of which selected 06 cross showing positive and significant SCA effects in one or more traits (Table-4). It is observed that GYP x TGBP showed significant effects in four traits and this cross combination has been selected as a hybrid for limited trials at the Institute level.

Table - 4: Reciprocal effects of selected crosses in 10X10 diallel crosses.

Crosses	Fecundity (Nos.)	Hatching (%)	Larval wt. (g)	ERR (%)	Cocoon wt. (g)	Shell wt. (g)	Shell ratio (%)
GYP x T GBP	2.65**	-2.42	1.33	0.78	4.34**	6.86**	3.45**
BGBZ x B YP	6.85**	-1.45	0.88	6.64**	-0.45	1.43	1.89
K YP x B YP	0.59	1.99*	3.08**	2.21*	2.35*	1.57	2.43*
K YP x T YS	1.79	2.14*	-0.72	4.19**	1.62	3.57**	2.20*
TGBS x G YP	6.92**	-1.74	-1.14	5.78**	0.17	2.41	5.25**
TGBSxB GBP	0.09	-0.90	-1.32	-3.26	-2.76	1.71	1.88

Based on positive and significant GCA effects in desired traits, 07 cross combination i.e., B YP x T GBP, C2 x BYP, BYP X T GBS, B GBPX T GBS, C2 X TGBP, C2 X T GBS and T GBP X B GBP were selected for development of promising breed.

INTER-SPECIFIC HYBRIDIZATION

Selfed BYP x Wild grainage was carried out to produce F2 seed and selfed F2 generation rearing was carried out by recording fecundity, hatching, larval weight, ERR, cocoon weight, shell weight, pupal weight and shell ratio shown in Table-1.

Table-1: F2 generation rearing of BYP x Wild.

Treat-ment	Fecundity (Nos.)	Hatching (%)	Larval wt. (gm)	ERR (%)	Cocoon wt. (gm)	Shell wt. (gm)	Shell Ratio (%)
B YP x Wild	287-331	78-84	7.23-7.51	56-79	3.30-3.57	0.43-0.47	13.03-13.16

The fecundity was low and not up to the desired level and when presented in 63rd RC, the house suggested repeating inter-specific hybridization work to get desirable results.

Selfed F4 and F5 generations are continued and all the rearing performance was recorded as shown in Table-2. Cocoon assessment of selfed F5 generation is completed and kept in normal room temperature for emergence.

Table - 2: Rearing performance of Selfed F4 and F5 generations.

Generations (F)	Fecundity (Nos.)	Hatching (%)	Larval wt. (g)	ERR (%)	Cocoon wt. (g)	Shell wt. (g)	Shell ratio (%)
Selfed F4	215	56.69	7.15± 1.98	33	2.45± 0.97	0.30± 0.64	12.24± 0.49
Selfed F5	185	45.69	7.39± 1.46	29	2.50± 0.32	0.33± 0.45	13.20± 0.19

Project Code: ARP05015SI

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
Total Budget Allocation : 19.92 Lakhs
Total Expenditure : 3.16 Lakhs
(During the year)
Scientist Involved : Dr. Arun Kumar K.P. PI
Dr. G. Subrahmanyam (up to 30.06.2021)

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 management of pebrine disease.

Summary of the achievements:

- For the efficacy analysis of the chemical disinfectants two different assays were performed invitro, motility assay and germination assay to test the survivability and infectivity of micrsporidian spores. Total 13 chemical disinfectants were tested and their effects were observed and recorded.

- Of the tested chemical disinfectants 3 were shortlisted for Insect bioassay studies namely 0.2 % NaOCl, 2% Nirmool, 3% Nimool and 5% Mancozeb75.
- Field trial experiment was performed with the shortlisted disinfectants and its effects on leaves of the host plants and the muga larvae were observed. 38.09% reduction of pebrine disease observed with 0.2% NaOCl with bleaching effect on the leaves and 47.17% reduction observed with 3% Nirmool without any bleaching effect on the foliage, whereas 5% Mancozeb was toxic for larvae and complete mortality was observed (Figure 1).
- An egg washing technique was experimented with 0.2% NaOCl and 3% Nirmool. Pebrine infected eggs were collected and categorized into high, medium and low-density spores depending on the spore load and washed with the mentioned disinfectants before rearing. Maximum cocoons collected in 0.2% NaOCl treated low and medium batch.
- The complete genome sequencing of Nosema sp collected from muga and eri silkworms has been completed and the detailed analysis is ongoing.

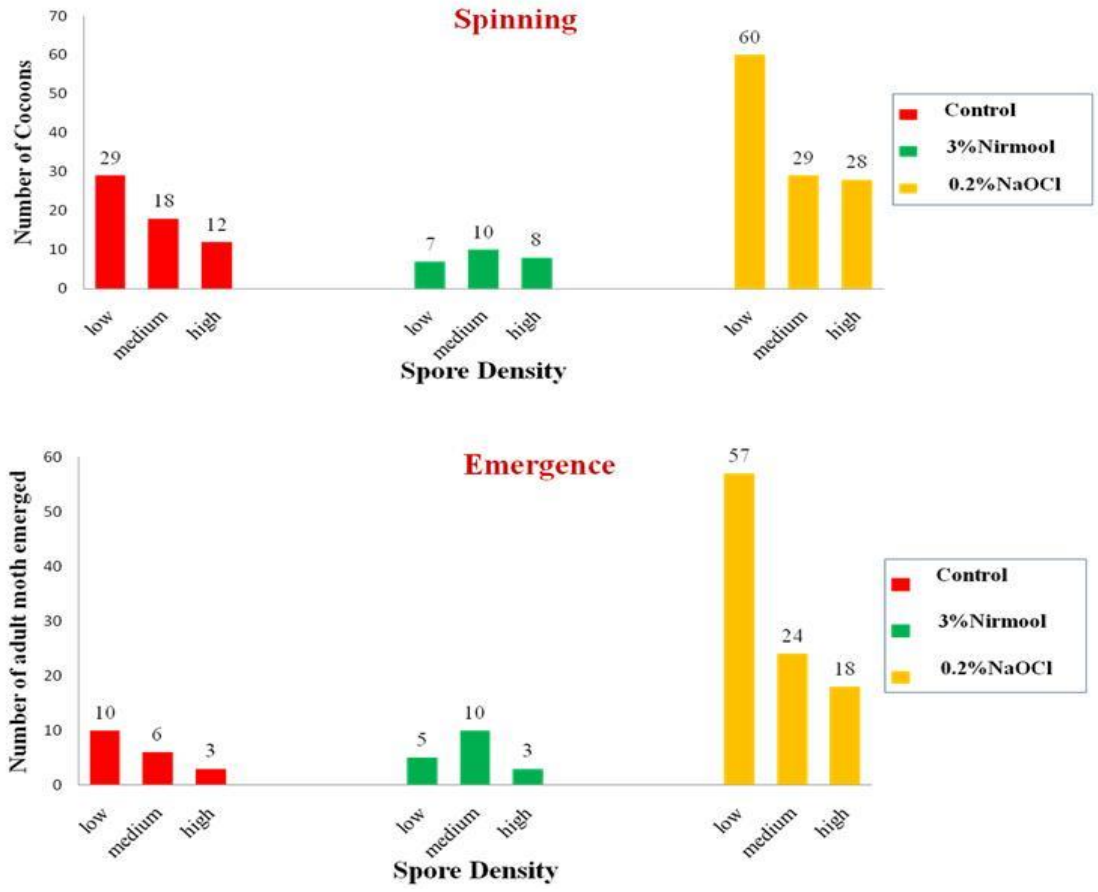


Fig 01: Cocoon number and number of emergence in different treatments

Project Code: APS05020MI
Project Title: Commercial egg production technology for ericulture
Project Period : February, 2022 to January, 2024
Funding Agency : Central Silk Board, Bengaluru
Total Budget Allocation : 14.65 Lakhs

Total Expenditure : 6.29 Lakhs
(During the year)
Scientist Involved : Dr. Mahesh D. S, PI
Dr. Lalitha Natarajan, Scientist D, EBSF, Topatoli, Co-PI
Dr. Arun Kumar K.P, CI

Objectives:

1. Standardization and selection of suitable egg laying device 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:

- Shortlisted the suitable egg laying device for large scale trials.
- Large scale trials have been conducted for commercial loose egg production by using selected device at CMER&TI & EBSF, Topatoli.
- All the grainage techniques for the shortlisted egg laying device are being standardized.
- Standardization of mass mother moth examination techniques for shortlisted egg laying devices is being carried out and will be repeated again for better conclusion.
- Early emerged moths are preserved at different temperatures to identify the best suitable condition for preservation and their re-use is being carried out.
- Standardization of black boxing for synchronization of hatching of different days laid eggs are being carried out.
- For the most accurate conclusion, the Eri silkworm seeds were stored at already developed preservation technology and with other various temperatures for their embryological developments were checked to observe the variations in development and hatching of worms.

Table 1: Egg laying performance of eri silkworms on different devices (per 100 moths):

Egg laying devices	Trial 1		Trial 2	
	Egg recovery per 100 moths (g)	Egg recovery per moth (g)	Egg recovery per 100 moths (g)	Egg recovery per moth (g)
Starch Sheet based WW	65.27	0.6527	62.12	0.6212
Sheet based WoW	64.32	0.6432	61.36	0.6136
Kharika (C)	65.15	0.6515	60.89	0.6089
Hanging cloth (Navy blue)	64.01	0.6401	60.17	0.6017
Nylon net	64.16	0.6416	59.83	0.5983
Starch coated PVC pipe	64.58	0.6458	60.90	0.6090
Individual boxes	64.29	0.6429	60.59	0.6059

Table 2: Large scale trials on commercial egg production practices and egg

Treatment	Trial 1		Trial 2		Trial 3	
	Egg recovery (g)	**Egg recovery / moth (g)**	**Egg recovery (g)**	**Egg recovery / moth (g)**	**Egg recovery (g)**	**Egg recovery / moth (g)**
T1 (250 KH)	141.81	**0.5672**	143.62	**0.5745**	157.69	**0.6308**
T2 (250 WL)	135.02	**0.5401**	139.95	**0.5598**	154.96	**0.6198**
T3 (150 KH)	84.17	**0.5611**	85.74	**0.5716**	95.48	**0.6365**
T4 (150 WW)	85.43	**0.5695**	86.76	**0.5784**	95.69	**0.6380**

Table 3: Black boxing trials for synchronization of hatching by using three days laid eggs

Black boxing (BB) schedule	1st trial			2nd trial			3rd trial		
	H (%)	**UH (%)**	**M (%)**	**H (%)**	**UH (%)**	**M (%)**	**H (%)**	**UH (%)**	**M (%)**
T1	88.40 ±2.70	**11.6 ±2.70**	0.00 ±0.00	86.80 ±1.64	**13.00 ±1.87**	0.20 ±0.45	86.00 ±2.92	**14.00 ±2.92**	0.20 ±0.45
T2	**95.4 ±1.67**	**4.00 ±1.22**	**0.60 ±0.89**	**95.2 ±2.59**	**4.20 ±2.68**	**0.60 ±0.55**	**94.6 ±1.44**	**4.60 ±1.14**	**0.8 ±0.45**
T3	89.80 ±2.39	2.60 ±0.89	**7.60 ±1.82**	90.00 ±3.08	2.80 ±0.45	**7.20 ±3.11**	91.80 ±1.30	3.00 ±1.22	**5.20 ±1.79**

H (%): Hatching %, UH (%): Un-hatched %, M (Mortality)

Table 4: Egg recovery from loose egg production by using sheets and kharika (Large scale trial):

Treatments	Quantity of cocoons (Kg)	Total number of cocoons	Avg. No. of cocoons per kg	Gravid female obtnd.	Total quantity of dfls obtnd. (gm)	Egg recovery per kg of cocoons (gm)	Fecundity per moth (gm)	Average number of eggs per dfl	Average number of egg retention (per moth)
T1 WoW (250 moths per tray)	30	9900	330	3707	2038.85	67.96	0.55	311.8 ±6.72	57.4 ±8.08
T2 Kharika (250 moths)	30	10230	341	3614	1915.42	63.84	0.53	310 ±5.15	62.6 ±10.54
T3 WW (150 moths per tray)	30	10080	336	3906	1992.06	66.40	0.51	308.8 ±2.86	47.40 ±5.68
T4 Kharika (150 moths)	30	9690	323	3800	2090.00	69.66	0.55	310 ±3.16	59.60 ±8.50

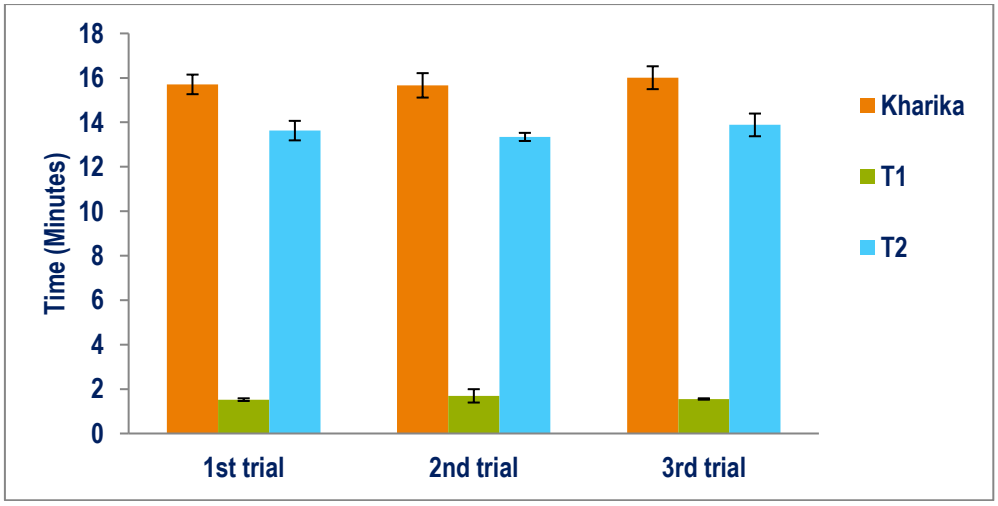


Figure 1: Time taken for placing gravid moths on the egg laying devices (250 moths)

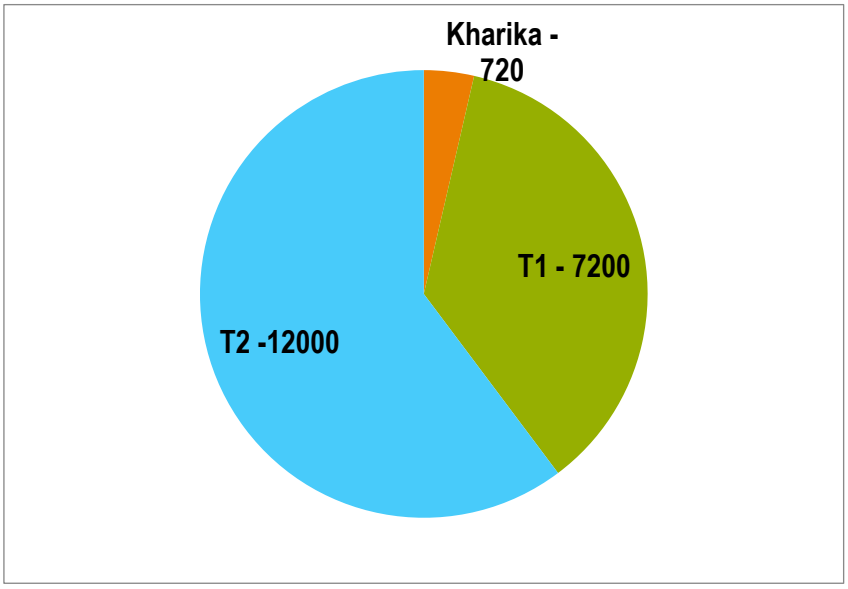


Figure 2: Number of DFLs can be produced at a time in 10x10 sq. ft. area by using different egg laying device

Figure 3: Emerged moth collection and allow them for coupling by creating dark condition in bamboo storage cages

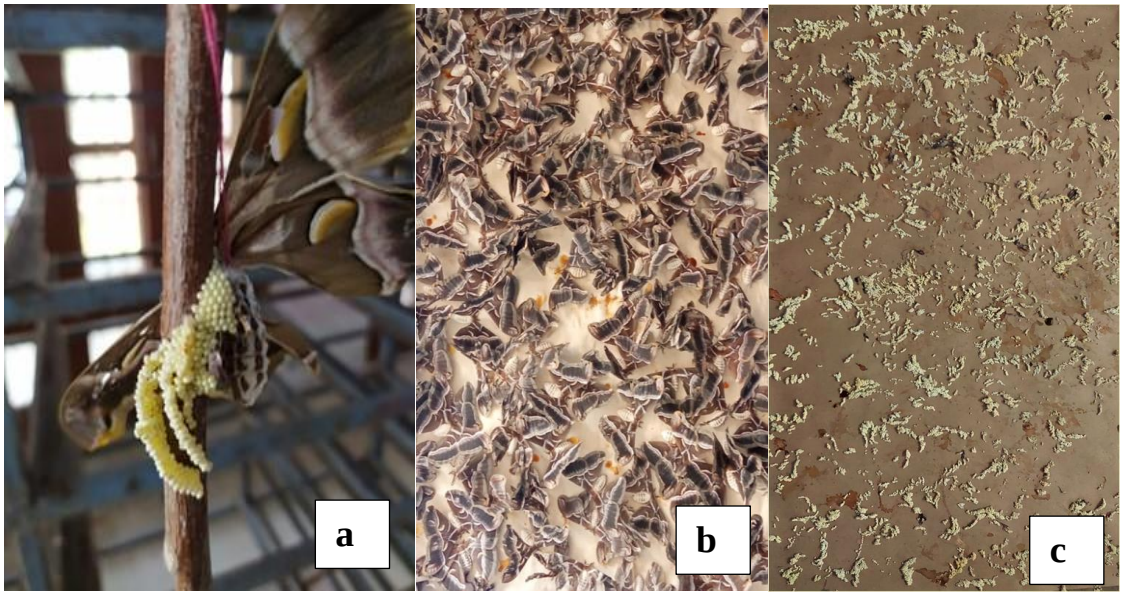


Figure 4: Individual kharika based (a) and commercial loose egg production in eri by using loose egg sheets (b,c)

Figure 5: Loose eggs sheets soaking, egg washing and disinfection (steps)

Figure 6: Egg laying of eri silkworms on different devices

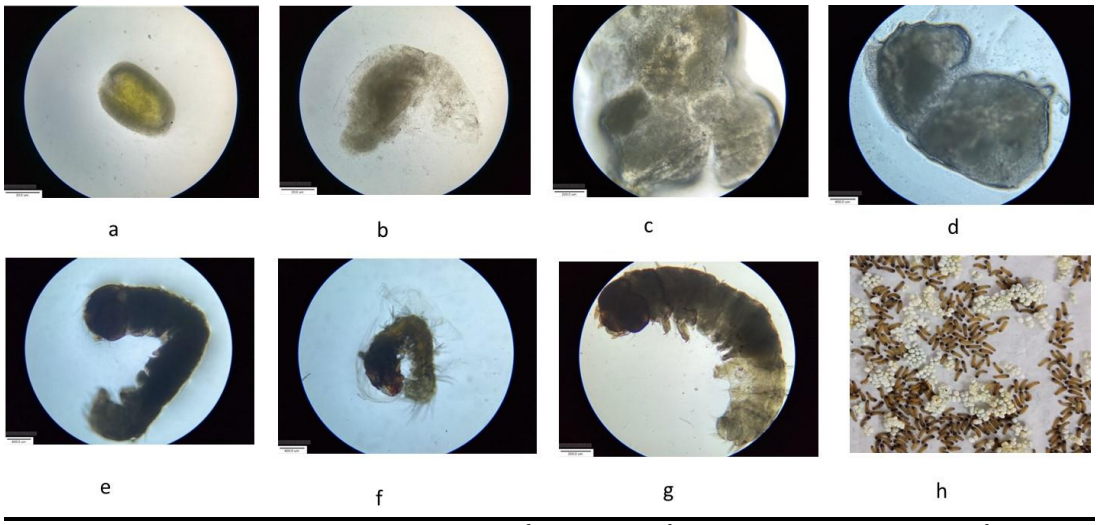


Figure 7: Embryo development: (a to g) 3rd day - to 9th day., h. hatching on 10th day.

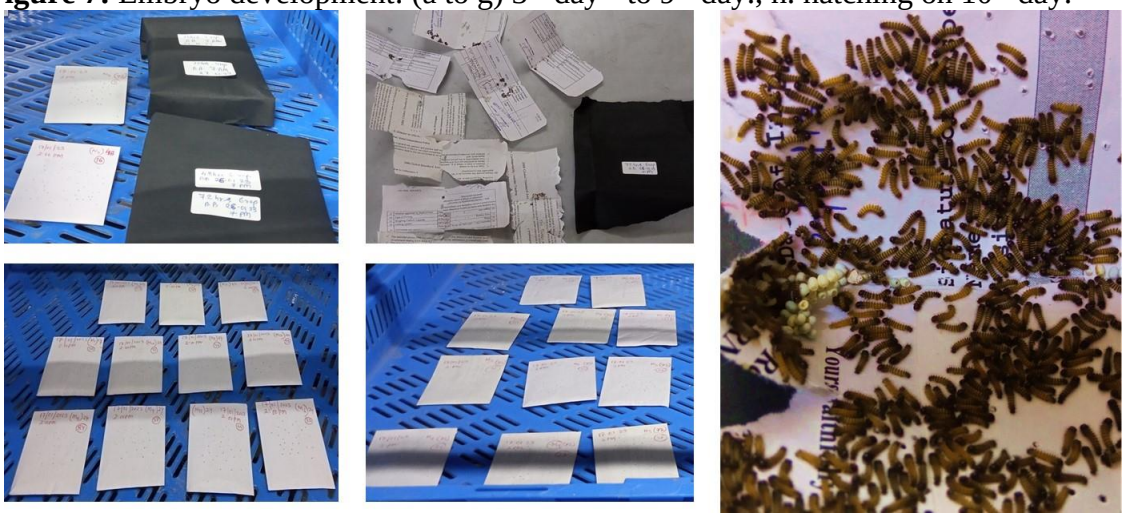


Figure 8: Hatching synchronization for different days laying using black boxing technique

Project Code & Title: BPS01013CN- Utilization and diversification of silkworm pupae products for human & animal consumption and composting.

Project Period **:** September, 2020 to March, 2023
Funding Agency **:** Central Silk Board, Bengaluru
Total Budget allocation **:** 11.88 Lakhs
Total expenditure (during the year) **:** 3.52 Lakhs
Scientists involved **:** Dr. Mahesh D. S, Scientist-C, CMER&TI (PI)
Dr. Dr. T. James Keisa, Scientist-D, CMER&TI (CI)

Objectives:

a) To evaluate nutrients and bioactive compounds in silkworm pupae of Eri and Muga.
b) To characterize proteome of Eri and Muga silkworm pupae.

Summary of the findings / achievements:

- The analysis of the nutritional composition of eri pre-pupae and matured pupae fed on different host plants was carried out to know the difference between the nutritional value of eri fed on different diets. The matured eri pupae recorded a higher content of protein and a lower content of lipid than the pre-pupae fed by different host plants, whereas the pre-pupae recorded a lower content of protein and a higher content of lipids. The consumption patterns of eri pupae in Northeast India can be correlated with this data on nutritional differences in eri pre-pupae and mature pupae as well as the local climatic conditions. In hilly areas and higher attitudinal places like Assam's border regions and Nagaland, where cooler temperatures prevail, people prefer pre-pupae due to their higher fat content. The consumption of fatty foods is considered beneficial in cooler regions as fats provide energy and help maintain body warmth. In plain areas of Assam and other Northeastern states with relatively warmer climates, mature pupae are preferred due to their higher protein content. Protein is an essential nutrient for muscle development and overall body function. This regional variation in consumption patterns is a practical adaptation to the nutritional needs dictated by the climate. The higher protein content of mature pupae meets the energy demands in warmer regions, while the higher fat content of pre-pupae provides additional insulation and energy in cooler areas. Matured pupae contain a higher amount of carbohydrates, ash, and reducing sugar compared to pre-pupae.
- Apart from studying the nutritional factors in eri pupae (whole mature pupae), a method for separating the pupal cuticle from the flesh for the purpose of studying nutritional value has been carried out. The pupal flesh contains higher levels of crude protein and crude fat compared to the cuticle. These higher protein and fat levels in the pupal flesh make it a more nutritious and energy-dense part, likely to support the development and growth of the pupa. The cuticle contains more carbohydrates and crude fibre compared to the pupal flesh. This could be because the cuticle provides the rigid outer layer of the pupa, which requires structural components like carbohydrates and fibre for its composition. The cuticle layer has a significantly higher ash content compared to the pupal flesh. Ash represents the mineral content of the sample, and its higher presence in the cuticle might be due to the fact that the cuticle serves as a

protective layer and is likely to contain more minerals for structural integrity and protection.

- The present study was also focused on the microbial diversity analysis of eri pupae reared on castor and muga pupae reared on som host plants. The research study assumed that the biochemical experiments on the *A. assamensis* and *S. ricini* silkworm pupae contained *Bacillus spp., Staphylococcus spp., Pseudomonas spp., Serratia spp., and Acinetobacter spp.* Among the different groups of microorganisms, bacteria are predominantly associated with eri and muga pupae, transiently or permanently. Microbial analysis of spent muga pupae by using Sanger dideoxy sequencing was also carried out and identified the microbial species *Viz., Exiguobacterium undae, Exiguobacterium antarcticum, Pantoeavagans, Exiguobacterium sp., Bacillus thuringiensis,* and *Staphylococcus capitis.*
- Compared the protein bands on the gel with the molecular weight markers to estimate the sizes of the proteins in eri and muga pupal samples by SDS-Page. Proteomics using LC-MS was carried out but targeted proteins could not be identified due to the non-availability of dedicated software/library to run the LC-MS data. The structural components of FE-SEM were also carried out.
- The sensory evaluation test for eri preserved pupae, eri pupal products, eri silkworm pupal pickle, and mulberry pupal products prepared by CSIR-CFTRI under the project was conducted in and around areas Jorhat and New, Chungthia, Nagaland. Preserved eri pupae by using natural preservatives at different temperatures were tested through sensory evaluation, and up to 4 days of pupae preserved at low temperatures (2–8^{o}C) were accepted by the panellists. Eri preserved samples at room temperature (Days 4, 6, 8, 10, and 12) and 2°C–8°C (Days 8, 10, and 12) were discarded since all the pupal samples were decayed. All the panellists accepted eri silkworm pupal products, eri pupal pickle, and mulberry pupal by each panellist, which will help in the future for commercialization at market level in traditional areas.
- The nucleotide sequences (of muga spent pupal bacteria) submitted and accessions obtained from NCBI. We have provided GenBank accession number(s) for your nucleotide sequence(s):

SUB11381930 K1 ON358387 SUB11381930 K2 ON358388 SUB11381930 N3 ON358389
SUB11381930 N4 ON358390 SUB11381930 N5 ON358391 SUB11381930 N7 ON358392
SUB11381930 N10 ON358393

Table 1: Nutrient composition of Eri matured pupae and pre pupae fed on different host plants:

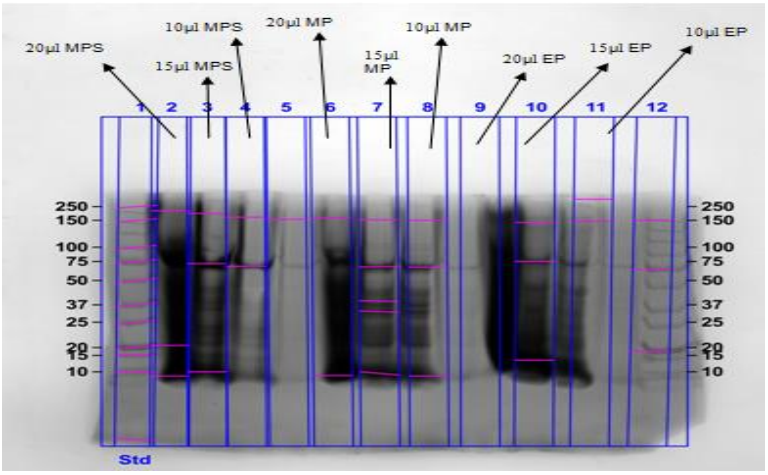
Nutritional compositions (%)	**Castor fed**		**Kesseru fed**		**Borpat fed**		**Tapioca fed**	
	Pre-pupae	**Matured pupae**	**Pre-pupae**	**Matured pupae**	**Pre-pupae**	**Matured pupae**	**Pre-pupae**	**Matured pupae**
Crude proteins	49.65 ±2.89	60.32 ±3.15	46.21 ±2.65	58.51 ±2.51	44.58 ±1.96	59.04 ±2.18	42.77 ±1.86	56.62 ±2.92
Carbohydrates	10.52 ±1.12	12.03 ±1.09	9.91 ±1.33	11.23 ±1.10	10.13 ±1.26	11.65 ±1.08	9.53 ±1.08	10.98 ±1.06
Total lipids	20.57	16.24	18.00	14.18	17.25	13.62	17.15	14.51

	±1.65	±1.45	±1.86	±1.29	±1.85	±0.97	±1.22	±1.29
Crude fiber	1.44 ±0.22	1.68 ±0.71	1.66 ±0.51	1.89 ±0.30	1.65 ±0.37	1.79 ±0.31	1.37 ±0.81	1.56 ±0.08
Ash	5.52 ±0.65	4.69 ±0.49	5.11 ±0.96	4.23 ±0.76	4.98 ±0.68	4.02 ±0.66	5.01 ±0.53	4.39 ±0.27
Reducing sugars	2.55 ±0.28	2.22 ±0.16	1.27 ±0.31	0.96 ±0.16	1.12 ±0.33	0.93 ±0.09	1.05 ±0.18	0.88 ±0.10

Note: The values of proximate composition are on a dry matter basis and expressed as percentage values (mean ± SD)

Table 2: Nutritional compositions of eri pupal flesh and cuticle layer after separation

Nutritional compositions (%)	**Eri matured pupal flesh (%)**	**Eri matured pupal cuticle (%)**
Crude proteins	54.33±3.65	39.18±2.13
Carbohydrates	11.80±1.25	15.94±1.17
Crude lipid/fat	17.40±1.80	6.53±0.26
Crude fibre	1.26±0.18	9.48±0.29
Ash	3.16±0.21	18.16±1.71
Reducing sugar	1.61±0.12	1.08±0.06



MP=Muga Pupae; EP= Eri Pupae and MPS= Muga spent pupae

Figure 1: GELDOC image of SDS-PAGE

After running gel electrophoresis, we observed the banding patterns and these patterns are formed by proteins migrating through the gel based on their molecular weights. The samples were loaded on to the gel in different microliter volumes. The distinct protein bands were identified in the gel and correlated their molecular weights to specific ranges, like 50-75 kDa, 37-25 kDa, and 20-15 kDa.It seems that 15 micro liters of sample volume provided the best clarity for observing the protein bands. These standards have known proteins with well-defined molecular weights that helps to estimate the molecular weights of the proteins in our samples.

LC-MS/MS analysis of eri and muga pupae and their host plant samples

The LC-MS/MS analysis is a liquid chromatography to separate the compounds in the extract and tandem mass spectrometry to identify and quantify these compounds based on their mass and fragmentation patterns.

Extraction by maceration method:

Extraction of eri and muga pupae and their host plant leaves was carried out by the maceration method using 70% ethanol as solvent, at a temperature of 30^0 C with a solid-liquid ratio of 15mL/g (expressed as solvent per gm of volume). The dry powder was weighed using a digital balance and blended with 70% ethanol as given in the following table-

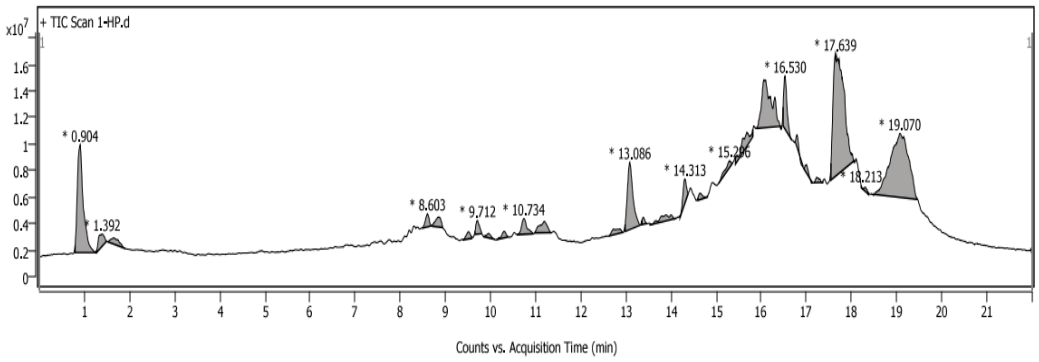
Sample details	Dry weight	Solvent volume
Som fed muga pupae	5.2g	75ml
Castor fed eri pupae	14g	210ml
Borpat fed eri pupae	13g	195ml
Tapioca fed eri pupae	6g	90ml
Kesseru fed eri pupae	13g	195ml
Castor leves	10g	150ml
Borpat leaves	12g	180ml
Kesseru leaves	10g	150ml
Tapioca leaves	10g	165ml

The extraction process was performed with an Innova Orbitek shaker at 30^0 C @200 RPM. The solvent mixtures were left in a shaking incubator for a period of 24 hours. Further, the extracts were separated from the residues by filtering through Whatman No. 1 filter paper. After filtration, the obtained extracts were concentrated and freed of solvent under vacuum below 45^0 C using a Rotary Evaporator. The resultant dried crude concentrated extracts were then stored at -20^0 C until LC -MS/MS analysis.

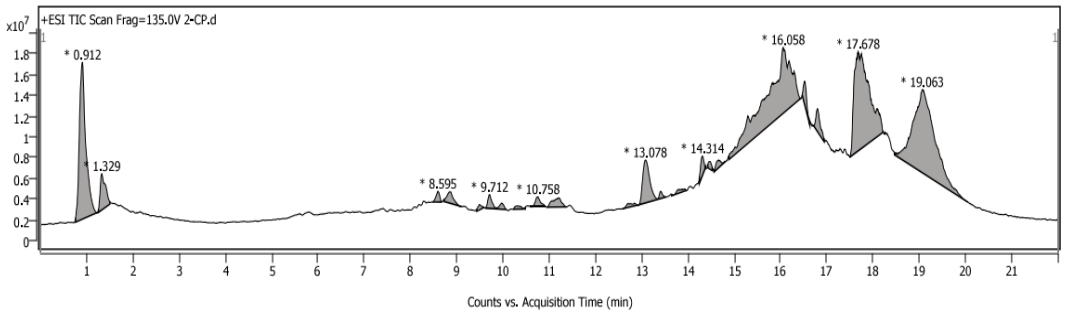
Results:

Chromatogram of Pupae Samples: 1-MP, 2-CP, 3-BP, 4-TP and 5-KP

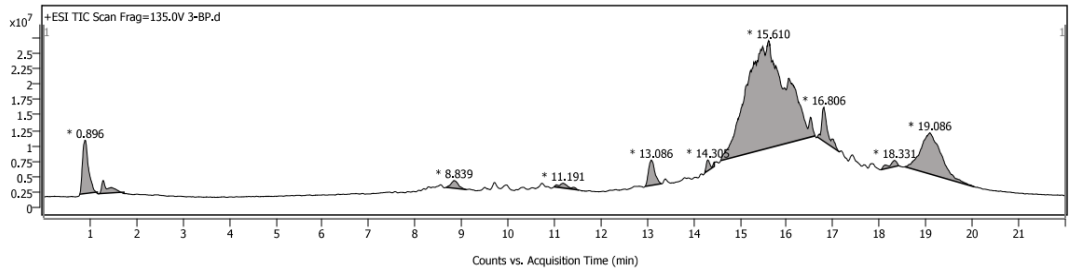
1-MP (Muga pupae)



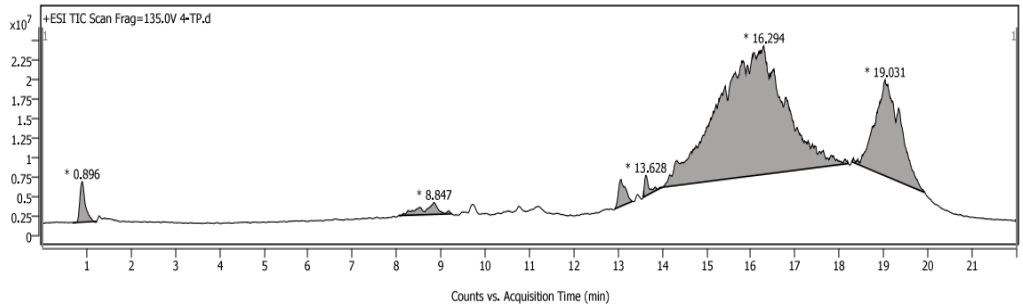
2-CP (Castor fed eri pupae)



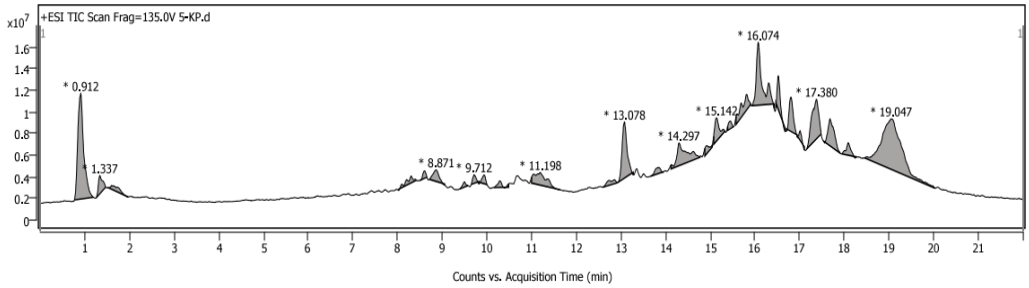
3-BP (Borpat fed eri pupae)



4-TP (Tapioca fed eri pupae)

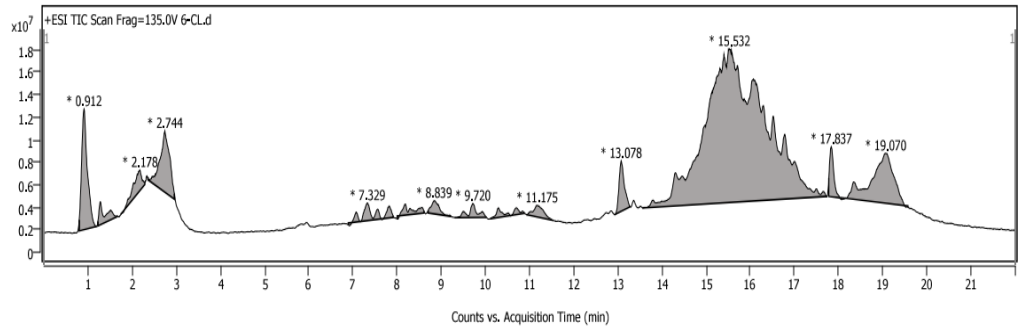


5-KP (Kesseru fed eri pupae)

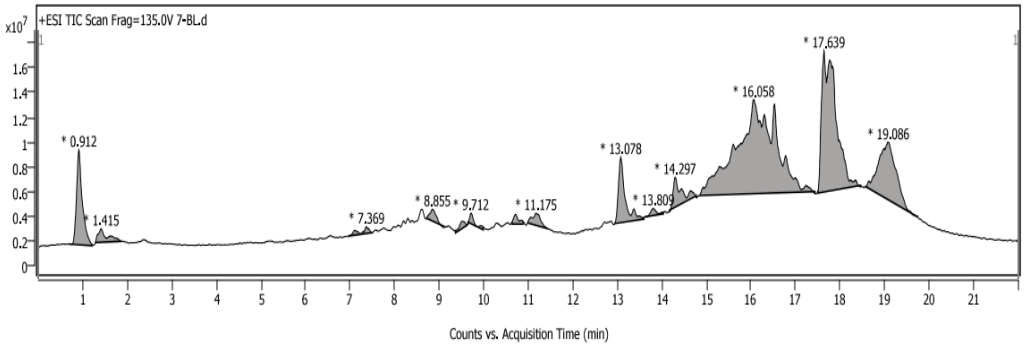


Chromatograms of Leaf Samples: 6-CL, 7-BL, 8-KL and 9-TL

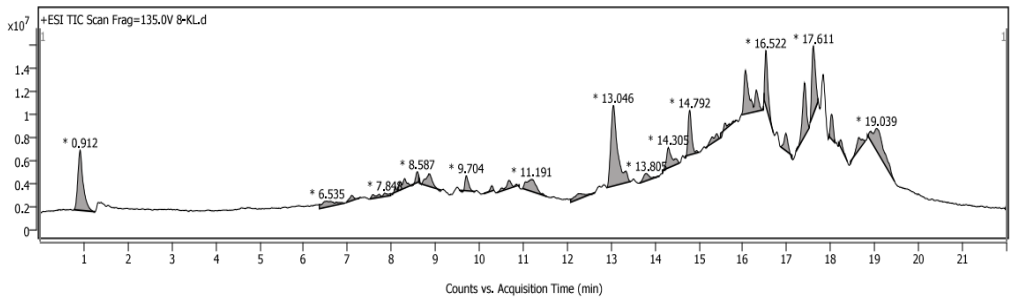
6-Castor leaves



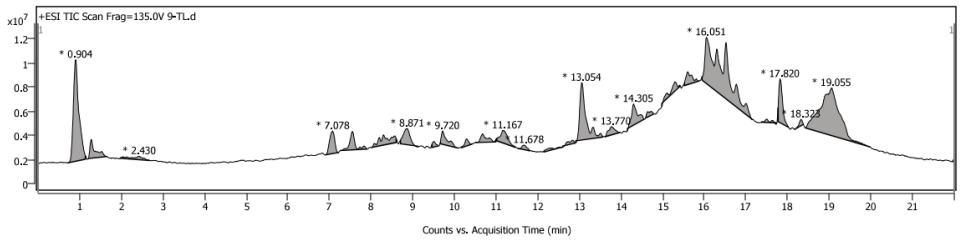
7-Borpat leaves



8-Kesseru leaves



9-Tapioca leaves



An attempt was made to identify the individual peaks. However, due to the non-availability of a proper database and dedicated software, it was unable to decipher the individual peptides. In already analyzed samples, peaks have been detected, which confirms the presence of several peptides or proteins in all the samples.

FE-SEM images of eri pupae: FE-SEM (Field Emission Scanning Electron Microscopy) images play a significant role in the study of Eri pupae and various other biological specimens. FE-SEM is a powerful imaging technique that uses electrons to create high-resolution, three-dimensional images of the surface of specimens. The morphological analysis has been conducted at IIT, Guwahati, to observe the detailed morphology and surface features of Eri pupae. These structures, like hairs, spines, scales, and other external features, may be important for taxonomic classification or understanding pupal development. The microstructure of the pupal body can provide insights into the arrangement of cells, tissues, and other substructures, contributing to a better understanding of its anatomy. The surface texture and topography can be crucial for understanding interactions with the environment, such as adaptations for camouflage or interactions with predators. Any abnormalities or deformities in the pupal stage could include malformations in the structure or surface of the pupae, which might provide insights into genetic or

environmental factors affecting pupal development. In summary, FE-SEM images are a valuable tool for studying the morphology, structure, and adaptations of Eri pupae.

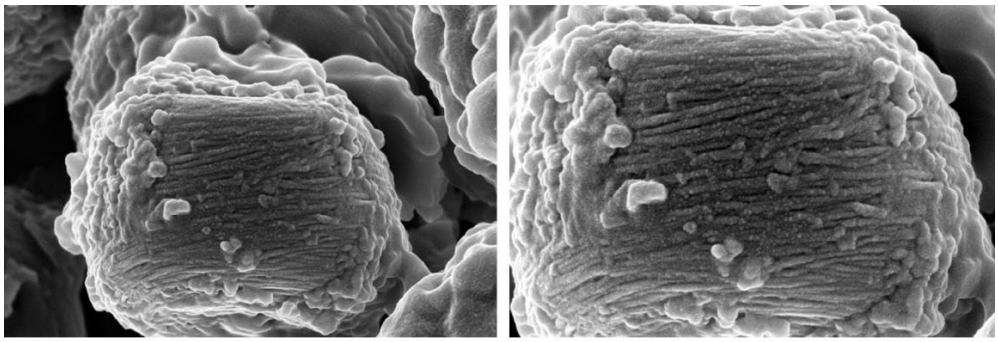


Figure 2: FE-SEM images of the protein particles eri pupal flesh (images taken at different magnifications)

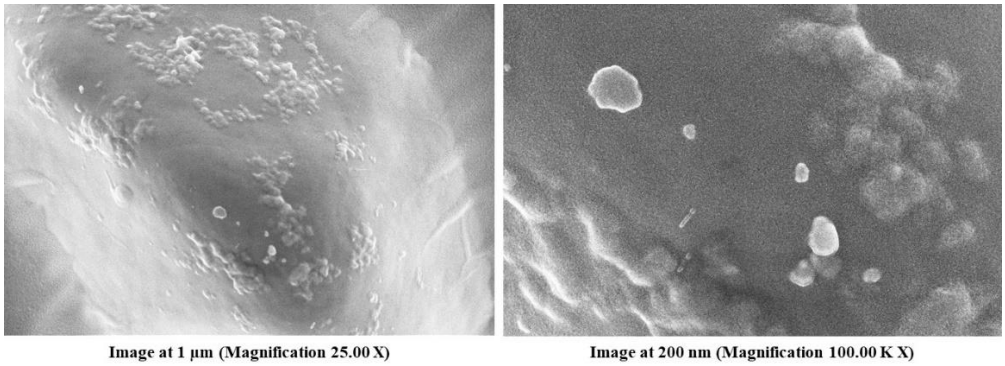


Figure 3: FE-SEM images of the chitin deposited on the eri pupal cuticle (images taken at different magnifications)

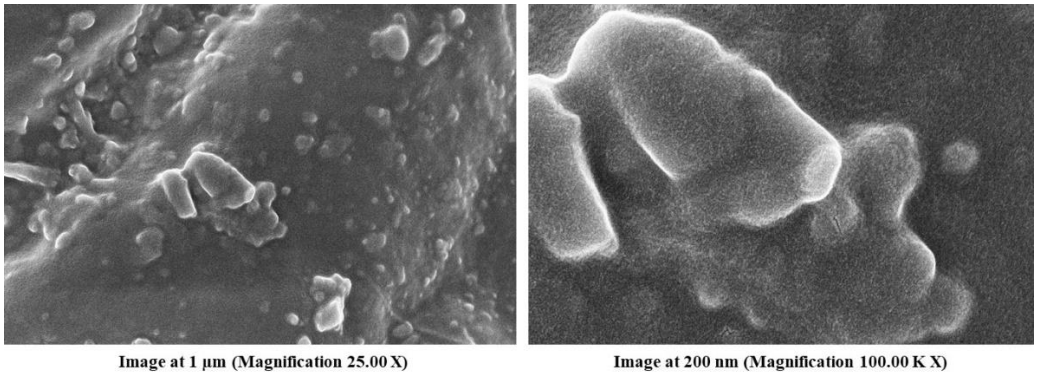


Figure 4: FE-SEM images of proteins bound in the eri pupal cuticle (inner layer) (images taken at different magnifications)

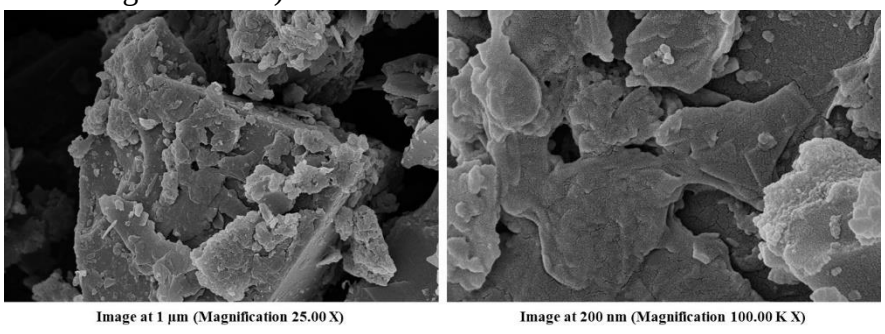


Figure 5: FE-SEM images of protein flakes present in the eri pupal dry powder (images taken at different magnifications)

Table 3: Sensory Evaluation of Eri Pupae Snack (Dry Spiced) at Jorhat (Assam)

Code	Overall Acceptability (10 participants)	Reasons
DST	7.4 ≈ 7 (Like moderately) **Acceptable**	Taste is somewhat bearable
OST	7.4 ≈ 7 (Like moderately) **Acceptable**	Taste is somewhat bearable
DCH	7.4 ≈ 7 (Like moderately) **Acceptable**	Taste is somewhat bearable
OCH	7.5 ≈ 8 (Like very much) **Acceptable**	Very good taste
DSP	7.5 ≈ 8 (Like very much) **Acceptable**	Very good taste
OSP	6.3 ≈ 6 (Like Slightly) **May be Acceptable**	Taste can be improved

Conclusion: OCH and DSP are rich in taste followed by DST>OST>DCH>OSP

Table 4: Sensory Evaluationof Eri pupal pickle– Jorhat District, Assam

Code	Overall Acceptability (15 participants)	Reasons
V	8.67≈ 9(Like extremely) **Acceptable**	Very good taste and smell
SVDG	8.60≈ 9 ((Like extremely) **Acceptable**	Very good taste and smell
VDG	8.67 ≈ 9(Like extremely) **Acceptable**	Very good taste and smell
SVDG	8.53 ≈ 9(Like extremely) **Acceptable**	Very good taste and smell

Conclusion: SVDG>VDG>V>SV all 4 types of eri pickle can be commercialized in the market.

Figure 6: Pictures of sensory evaluation test for eri pupal pickle conducted at CMER&TI, Jorhat, Assam

खाद्य पौध विभाग

HOST PLANT DIVISION

CONCLUDED PROJECTS

Project Code: PIB-05005-SI

Project Title: Genetic enhancement of Castor (*Ricinus communis* L.) germplasm as a source material for development of productive perennial varieties.

Project Period	: December 2019 to September 2022
Funding Agency	: Central Silk Board, Bengaluru
Total Budget Allocation	: Rs. 13.30 lakhs
Total Expenditure (During the year)	: Rs. 3.90 lakhs
Scientist Involved	: Dr. Aftab A. Shabnam, CMER&TI, PI Dr. Amit Kumar, CMER&TI, CI (till 04.07.2022) Dr. Dharmendra Kumar Jigyasu, CMER&TI, CI Dr. L. Somen Singh, CI, RSRS, Imphal

Objectives:

1. Genetic enhancement of castor germplasm
2. Development of pre-bred intermediate castor with perennial characteristics.

Summary of the findings/achievements :

- Gene pool was enriched up to 33 castor accessions.
- 25 perennial and 02 annual accessions have been collected from Northeast India.
- 03 annual castor varieties (DCS-9, ICH-66 and DCH-519) collected from IIOR, Hyderabad. 01 wild perennial castor accession collected from Lucknow and 02 perennial castor varieties (Kalpi-6 and YTP-1) collected from UP and TNAU, Tamil Nadu respectively.
- Enrichment of gene-pool and its characterization will give breeders choice of selecting desired parents for future breeding programmes for improvement of castor.
- **1st crossing lot:** 12 different forward and reciprocal cross combinations were made. Selections made in F_2 generation & F_3 generation in progress.
- **2nd crossing lot:** 17 cross combinations were carried out and F_1 seeds of 15 crosses harvested. F_2 generation in progress.
- **Mass selection lot:** Selfed F_2 seeds of potential perennial accessions were sown for mass selection.
- 12 perennials, 02 leaf morphotypes and 03 profusely branched lines were selected in F2 generation during 1st phase of the project. These lines will be maintained, selfed and recurrent selection will be carried out till F7 generation to attain homogeneity in 2nd phase of the project.
- Recurrent selection of these lines in subsequent generations will lead to development of intermediate/superior perennial castor cultivar.
- Published a Book: "Descriptor cum catalogue: Characterisation of eri silkworm major host plant castor (*Ricinus communis* L.) germplasm."

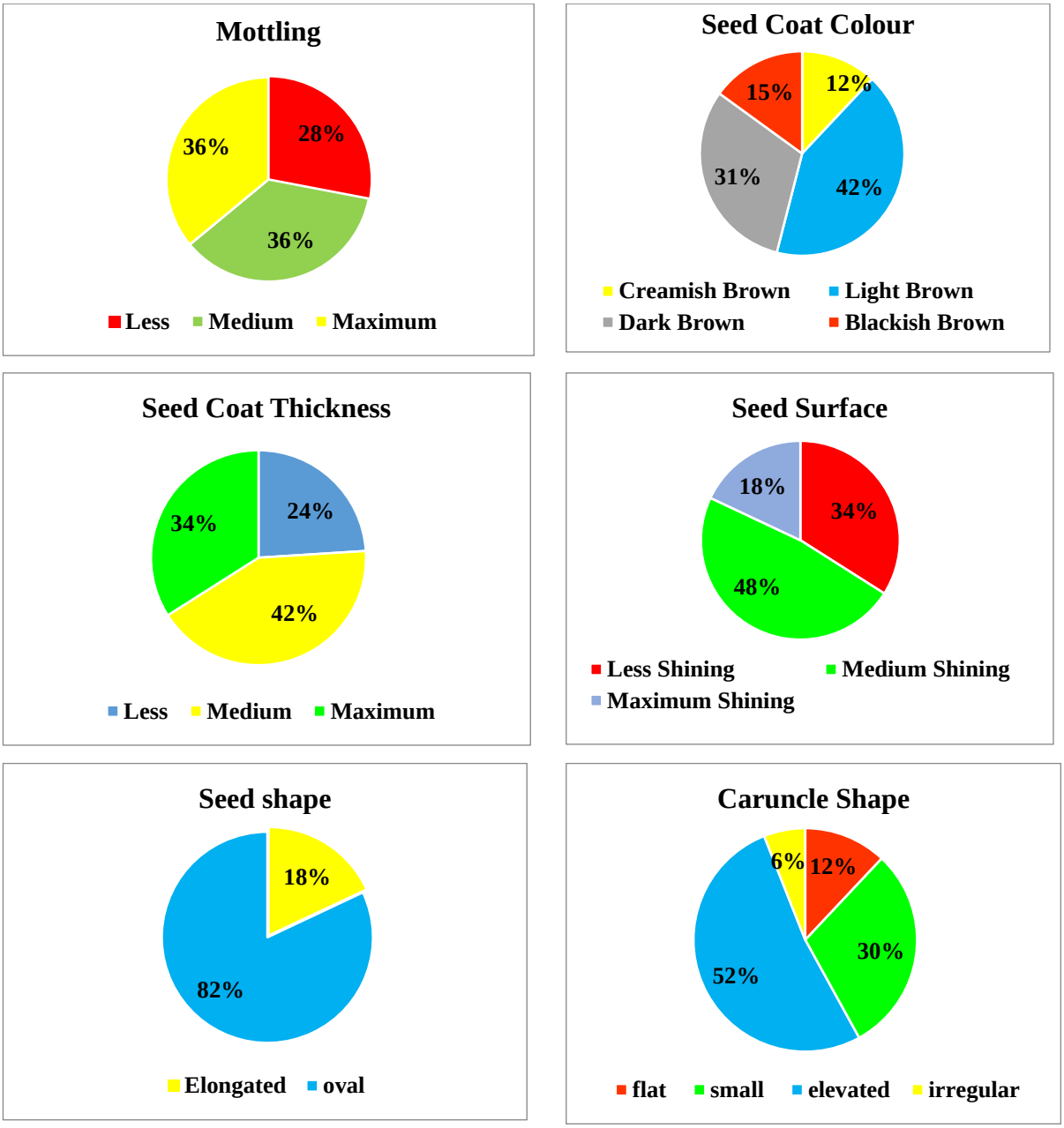


Fig. 1: Pie chart on variability in the seeds of 33 castor accessions/ varieties:

Comparative Bio-chemical trait analysis:

Total 15 castor accessions were characterised for biochemical parameters like pH, chl a (mg/g of FW), chl b (mg/g FW), total chl (mg/g FW), chl a/b, carotenoid (mg/g FW), total chl/ carotenoid, anthocyanin, protein (mg/g FW), carbohydrate (mg/g FW), total sugar (mg/g FW), phenol, (mg/g FW), amino acid, (µg/g FW), LMC (%), MRC (%). All other biochemical parameters have been found significantly different except Total Chl, Carotenoid and Phenol content in castor leaves of 15 accessions.

Table 1: Mean, range and variability of biochemical traits of 15 castor accessions.

	pH	Chl a (mg/g)	Chl b (mg/g)	Total Chl (mg/g)	Chl a/b	Carotenoid (mg/g)	Total Chl/ Carotenoid	Anthocyanin
Range	5.4-5.7	1-1.54	0.64-1.5	2.04-2.8	0.66-2.3	0.47-0.95	2.65-5.65	3.64-12.57
Mean ± SE	5.63 ±0.02	1.43± 0.02	0.92± 0.05	2.35 ±0.05	1.71 ±0.07	0.70±0.02	3.45 ±0.09	6.99 ±0.50
CV %	2.63	10.28	33.65	13.3	27.64	19.28	17.22	48.16

	Protein (mg/g)	Carbohydrate (mg/g)	Total Sugar (mg/g)	Phenol (mg/g)	Amino Acid (µg/g)	Leaf moisture content (%)	Moisture retention capacity (%)
Range	6.47-11.31	20.6-42.89	0.8-1.45	1.02-1.78	0.8-0.951	74.5-80.81	81.1-91.44
Mean ± SE	9.02±0.25	32.67 ±0.88	0.98±0.03	1.39±0.05	0.88±0.01	76.99±0.30	86.35±0.73
CV %	18.37	17.99	22.61	24.86	4.26	2.61	5.68

Comparative Metric trait analysis:

The comparative Metric trait analysis provides valuable information about the variation in these selected lines among the different F2 selections from the first crossing lot (table 2). This data is essential for understanding the genetic diversity and potential phenotypic outcomes resulting from the crossing of these specific parent plants. Researchers and breeders can use this information to make informed decisions about selecting plants with desired characteristics for further breeding for eri sericultural purposes.

Table 2: Comparative Metric trait analysis of F_2 selections from 1st crossing lot

Selections	Plant height (m)	Inter-nodal distance (cm)	Leaf area (sq.cm)	Lobe length (cm)	Lobe breadth (cm)	Petiole length (cm)	Petiole dia. (mm)
P_1 ($A_1 \times A_{19}$)	1.23	12.5	658.9	22	11	32	15.52
P_2 ($A_1 \times A_{19}$)	1.17	11.1	612.6	19	11	28	12.69
P_3 ($A_1 \times A_{19}$)	1.64	16.6	558.5	21	10	30	13.47
P_4 ($A_{19} \times A_1$)	1.09	16.6	584.2	22	12	31	18.19
P_5 ($A_{19} \times A_1$)	1.51	12.5	641.1	17	10	30	10.22
P_6 ($A_{19} \times A_1$)	1.45	11.1	589.7	17	11	33	18.38
P_7 ($A_{19} \times A_1$)	0.98	10	604.4	22	12	35	12.67
P_8 ($A_{19} \times A_1$)	1.29	11.1	686.3	21	10	32	13.94
P_9 ($A_3 \times A_{19}$)	1.67	12.5	511.4	19	11	31	9.98
P_{10} ($A_3 \times A_{19}$)	1.44	16.6	607.9	20	14	34	12.75
P_{11} ($A_2 \times A_{19}$)	1.36	10	567.6	22	12	29	9.64
P_{12} ($A_2 \times A_{19}$)	1.17	10	688.5	21	14	36	10.66
NBR	1.97	16.6	771.0	23	15	37	18.69

Continued….

Selections	Stem diameter (mm)	No. of shoots/ plant (No)	Total shoot length (m)	No of lobes (No)	10 leaf wt (g)
P_1 ($A_1 \times A_{19}$)	22.36	8	4.65	10	172.3
P_2 ($A_1 \times A_{19}$)	18.91	6	5.54	11	156.2
P_3 ($A_1 \times A_{19}$)	20.34	5	4.32	9	144.6
P_4 ($A_{19} \times A_1$)	20.48	7	4.88	10	139.7
P_5 ($A_{19} \times A_1$)	22.31	6	4.39	10	149.2
P_6 ($A_{19} \times A_1$)	25.37	8	6.97	9	160.2
P_7 ($A_{19} \times A_1$)	27.92	8	6.36	11	159.7
P_8 ($A_{19} \times A_1$)	27.11	7	4.64	9	177.6
P_9 ($A_3 \times A_{19}$)	25.25	9	6.49	9	162.4
P_{10} ($A_3 \times A_{19}$)	18.63	5	3.87	11	185.6
P_{11} ($A_2 \times A_{19}$)	23.44	8	5.10	10	168.6
P_{12} ($A_2 \times A_{19}$)	15.92	6	3.74	11	176.9
NBR	30.54	9	7.62	10	196.2

ON GOING PROJECTS

Project Code: AIP-05013-SI

Project Title: Impact of elevated CO_2 and temperature in muga Silkworm and its primary host plants

Project Period : March, 2020 to February, 2023 (extended upto Feb 2025)
Funding Agency : Central Silk Board, Bangalore
Total Budget Allocation : Rs. 44.72 lakhs
Total Expenditure (During the year) : Rs. 2.39 lakhs
Scientist Involved : Dr. D. K. Jigyasu, PI
Dr. Amit Kumar, PI (till 04.07.2022)
Dr. Aftab. A. Shabnam, CI
Dr. G. Subramanyam, CI (up to 26.07.2021)

Objectives

1. To assess the influence of elevated CO_2 and temperature on growth and yield attributes of primary host plant (Som).
2. To assess the impact of elevated CO_2 and temperature on muga seed crop production, cocoon characteristics and fecundity.
3. To design strategies for adoption in muga silk worm rearing under the changing environmental scenario in Assam.

Summary of the findings/achievements:

- Treatment of elevated CO_2 and temperature on Som plants was started in August, 2022 and going on as per work plan.
- Biochemical analysis of selected Som plants before and after treatment of 06 months has been completed and found significant changes in Protein and Ascorbic acid content.

Table 1: Initial analysis of Som plant leaves samples were carried out to check the nutrient status of plants and also compared with the biochemical analysis after the six months treatment.

Som plants in OTC	Carbohydrate (mg/ml)	Protein (mg/ml)	Chl A (mg/g FW)	Chl B (mg/g FW)	Total Chl. (mg/g FW)	Carotenoid (mg/g FW)	Total Sugar (mg/ml)	LMC (%)	Total Phenol (mg/g)	Ascorbic acid (mg/g)
OTC-1 (eCO2)	14.26 ± 2.02	20.06 ± 2.61	0.82 ± 0.09	0.63 ± 0.14	1.08 ± 0.13	0.33 ± 0.05	12.03 ± 1.17	78.00 ± 1.72	30.32 ± 3.82	20.36 ± 1.18
OTC-2 (eTemp)	14.64 ± 2.18	23.49 ± 5.17	0.96 ± 0.10	0.45 ± 0.01	1.21 ± 0.02	0.23 ± 0.0	12.55 ± 0.95	76.60 ± 5.89	31.74 ± 0.70	20.12 ± 1.08
OTC-3 (eCO2+ eTemp)	12.98 ± 2.28	21.57 ± 1.79	0.93 ± 0.08	0.50 ± 0.02	1.42 ± 0.09	0.38 ± 0.04	15.51 ± 1.92	76.55 ± 4.41	28.31 ± 1.25	19.57 ± 0.94
OTC-4 (Ambient)	15.67 ± 1.07	20.27 ± 3.41	0.83 ± 0.10	0.43 ± 0.05	1.26 ± 0.08	0.28 ± 0.01	12.13 ± 1.80	79.35 ± 4.26	26.79 ± 1.48	20.08 ± 0.10
C.D.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 2: Analysis of Som plant leaves samples were carried out to check the impact of nutrient status of plants after the six months treatment.

Som plants in OTC	Carbohydrate (mg/ml)	Protein (mg/ml)	Chl A (mg/g FW)	Chl B (mg/g FW)	Total Chl. (mg/g FW)	Carotenoid (mg/g FW)	Total Sugar (mg/ml)	LMC (%)	Total Phenol (mg/g)	Ascorbic acid (mg/g)
OTC-1 (eCO2)	22.50 ± 1.31	1.39 ± 0.18	0.86 ± 0.08	0.49 ± 0.06	1.13 ± 0.07	0.27 ± 0.08	14.31± 1.41	82.74 ± 1.75	17.76 ± 1.13	14.68 ± 0.63
OTC-2 (eTemp)	22.70 ± 1.73	1.16 ± 0.19	0.83 ± 0.03	0.40 ± 0.06	1.23 ± 0.03	0.17 ± 0.02	13.57 ± 1.10	82.73 ± 3.66	19.46 ± 1.56	17.55 ± 1.40
OTC-3 (eCO2+ eTemp)	20.74 ± 2.40	1.45 ± 0.09	0.85 ± 0.06	0.44 ± 0.06	1.29 ± 0.08	0.28 ± 0.07	13.84± 0.85	83.04 ± 3.00	18.98 ± 1.40	15.05 ± 0.70
OTC-4 (Ambient)	24.26 ± 1.93	2.46 ± 0.03	0.88 ± 0.06	0.39 ± 0.06	1.24 ± 0.08	0.31 ± 0.07	12.13 ± 1.80	82.29 ± 4.06	20.39 ± 0.65	20.17 ± 0.47
C.D.	N/S	0.42	N/S	N/S	N/S	N/S	N/S	N/S	N/S	2.73

Table 3: Student T-test was used to compare treated plants (6 months treatment) with initial plants.

Parameters	Carbohydrate (mg/ml)	Protein (mg/ml)	Chl A (mg/g FW)	Chl B (mg/g FW)	Total Chl. (mg/g FW)	Carotenoid (mg/g FW)	Total Sugar (mg/ml)	LMC (%)	Total Phenol (mg/g)	Ascorbic acid (mg/g)
t- test	-10.13	5.02	-0.12	0.12	0.04	0.51	-0.25	-1.57	1.76	-1.00
Significant	Yes	Yes	No	No	No	No	No	No	No	No

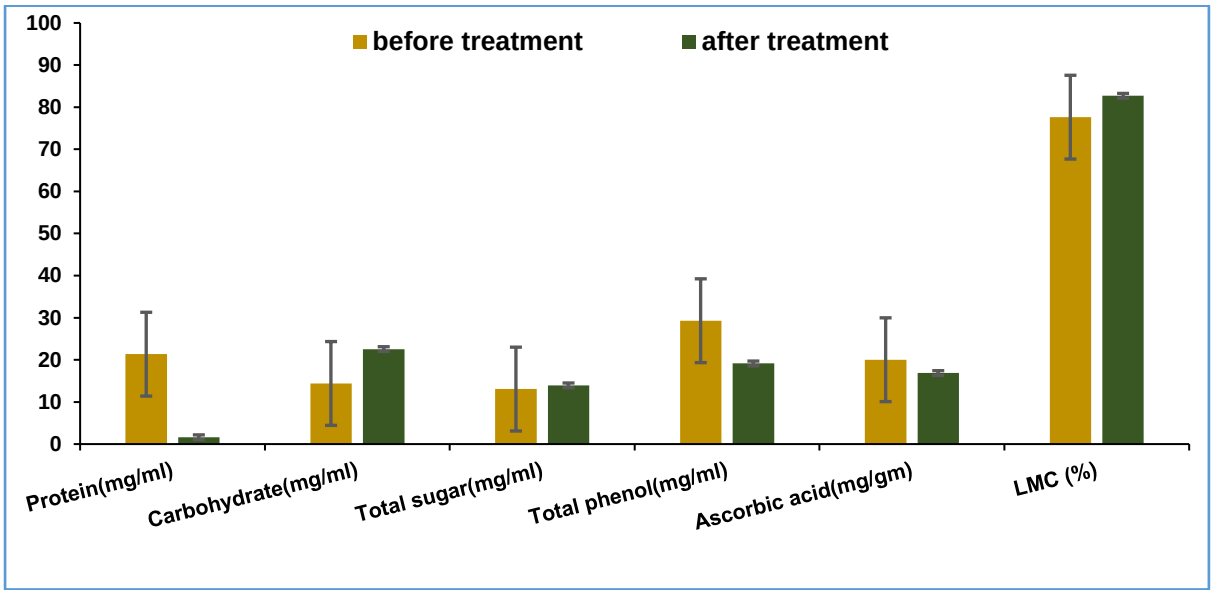


Figure: Biochemcial analysis of treated and untreated (6 months) leaves of Som plants.

Project Code: APR 05018MI

Project Title: Effect of various host plants separately and in combination on rearing and grainage performance of muga silkworm, *Antheraea assamensis* Helfer

Project Period : March 2021 to February 2024

Funding Agency : Central Silk Board, Bengaluru

Total Budget Allocation : 7.62 lakh

Total Expenditure (During the year) : Rs 3.42 lakh

Scientist Involved : D K Jigyasu, CMER&TI, PI
Kh. Subadas Singh, PI (till-04.07.2022)
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 rearing performance of muga silkworm.

2. To study the various host plants separately and in combination on grainage performance of muga silkworm.

Summary of the findings/achievements :

CMER&TI, Lahdoigarh:

Muga silkworm rearing was conducted on four different food plants viz., Som (*Persea bombycina*), Saolu (*Litsea monopetela*), Dighloti (*Litsea salicifolia*) and Mejankari (*Litsea cubeba*). Experimentally 4 solo and 12 combinations of host plants were conducted during four crops viz., Chatua (Feb-March, 2022), Jethua (April-May 2022), Kotia (Oct-Nov. 2022) and Jarua crops (Dec 2022-Jan 2023). Results of the Experiment are precisely given below as-

- In *Jethua* (April-May 2022) commercial crop, in respect to the rearing performance on different host plants Som exhibited better results in terms of ERR% (56), followed by Soalu (49). Soalu fed worms found higher larval weight (9.71g ♂, 11.72 g ♀), cocoon weight (5.40g ♂, 7.31g ♀) and fecundity (171). In combination, Som + Soalu vice-versa gave better results with good ERR% (41-49) and fecundity (119-124).
- In *Kotia* (Oct-Nov 2022) main commercial crop, Som host plant exhibited better performance in terms of ERR% (54), larval weight (9.18g ♂, 11.45g ♀), cocoon weight (4.88g ♂, 7.68g ♀), shell weight (0.50g ♂, 0.66g ♀), shell ratio (10.19% ♂, 8.60% ♀), fecundity (242) and hatching % (81%) as compared to other food plants.
- In *Jarua* (Dec 2022- Jan 2023) pre-seed crop, Som host plant performed better in terms of ERR% (58), larval weight (7.69g ♂, 9.75g ♀), cocoon weight (4.38g ♂, 6.03g ♀), shell weight (0.39g ♂, 0.44g ♀), shell ratio (8.92% ♂, 7.28% ♀), hatching % (63.88%) as compared to other food plants.
- Combination of Som + Soalu (vice-versa) followed by combination of Dighloti performed better.
- Highest fecundity was recorded in Som solo rearing in *Kotia* (242) crop followed by Soalu solo rearing during *Jethua* (171), Jarua (228) & *Chatua* (171) crops.
- Highest mortality was observed in the silkworm reared on Mejankari and combination of Mejankari + Dighloti.
- It is observed that the early worms fed on Som & Soalu showed reluctant to feed when transferred to Mejankari. However, the early worms fed with Mejankari and Dighloti showed readily feeds on primary host plants, Som & Soalu after transferred.
- Som exhibited shorter larval duration and longer larval duration was observed in Mejankari and in combination rearing with Mejankari & Dighloti.

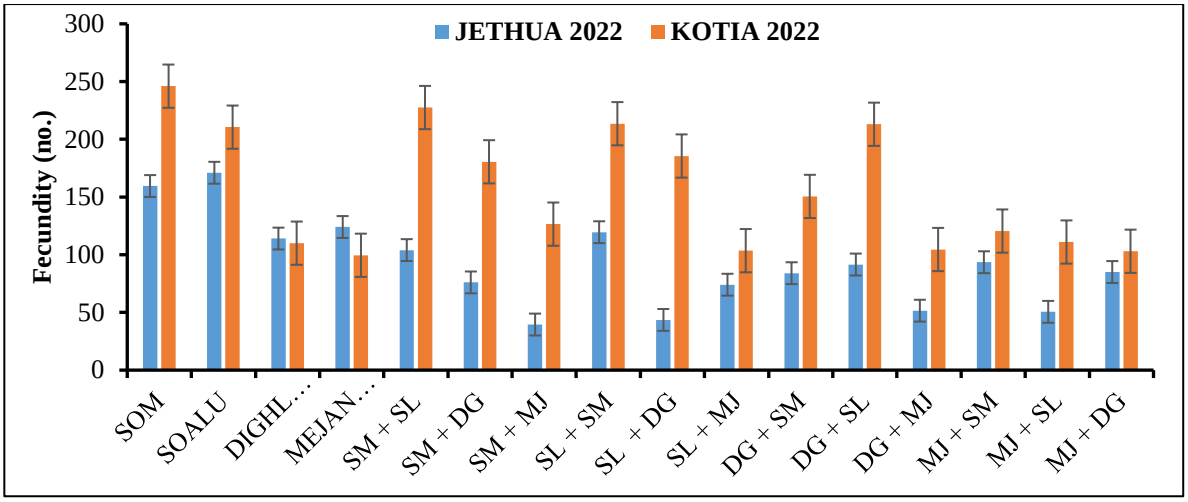


Fig. 1: Fecundity of Muga silkworm after rearing of commercial crop.

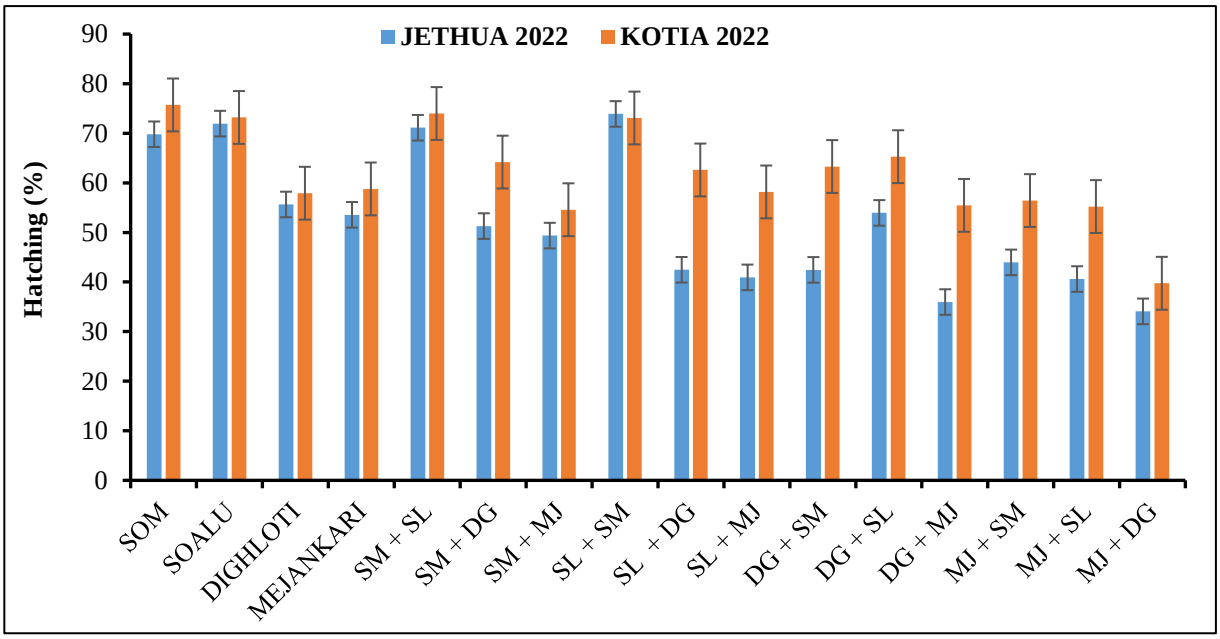


Fig. 2: Hatching percentage of Muga silkworm was recorded after grainage of commercial crop.

Fig. 3: Muga silkworm rearing on Majenkari, Majenkari tree with leaves, fully eaten leaves of Majenkari and cocoons from different host plants.

Project Code: MOE-05022-MI

Project Title: Evaluation and popularization of improved technologies developed in the field of Muga, Eri and Oak sector for Northeastern India (On-station/On-farm Trials of CMER&TI, Lahdoigarh)

Project Period : February 2022 to March 2024

Funding Agency : Central Silk Board, Bangalore

Total Budget Allocation : Rs. 36.02 lakh

Total Expenditure (During the year) : Rs. 3.22348 Lakh

Scientist Involved : Dr. D K Jigyasu, CMERTI, PI
Dr. Reeta Luikham, CMERTI (CI), Sri Suraj Pal, REC-Fatehpur (CI), Dr. James T Keisa, CMERTI (CI), Dr. Y Debaraj, RSRS-Imphal (CI), Dr. L. Somen Singh, RSRS-Imphal (CI), Sri. B N Choudhury, RSRS-Boko (CI), Sri SAS Rahman, RSRS-Boko (CI), Dr. D. Mech, CMERTI, (CI), Dr. Aftab A Shabnam, CMERTI (CI), Dr. S. Subharani Devi, RSRS-Imphal (CI), Dr. Arun Kumar KP, CMERTI (CI), Dr. Amit Kumar, CMERTI (CI), Dr. Kh. Subadas Singh, RSRS-Imphal (CI), Dr Vijay. N, CMERTI (CI), Dr. Mahesh D S, CMERTI (CI), Dr. Manjunath R N, CMERTI (CI), Mr. Abhishek Singh, MESSO (CI)

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:

- OST of 9 technologies and OFT of 12 technologies were carried out at different locations covering 485 beneficiaries against a target of 700 beneficiaries.
- The rearing management during summer months leads to increased availability of quality DFLs for rearing during next commercial season of Sep-Oct. Therefore, the OST on rearing management of muga silkworms in cooler regions during summer months holds a lot of promise in increasing overall production of muga silk. Three locations were selected for rearing during summer season of July-August months. 500 gm eggs were supplied to CMER&TI (Lahdoigarh), Wokha, Nagaland (Near Merapani) and MESSO (Rompara). Among 3 locations 2 locations are cooler regions i.e., Wokha, Nagaland (Near Merapani) and MESSO (Rompara) and one location is a traditional muga growing region where the July-August months were hotter i.e., CMER&TI (Lahdoigarh).
- The data shows that 60% hatching% was found both slot in Jorhat, Assam, 50% & 52% in Wokha, Nagaland and 77% & 76% in Rompara, Meghalaya. Pupation % was highest in Wokha, Nagaland, Slot-2 (94.11%) whereas lowest in Rompara,

- Meghalaya Slot-2 (85.19%). Cocoon yield highest in Wokha, Nagaland slot-2 (34). Highest % of good cocoon was found in Wokha, Nagaland Slot-2 (94.11%). Highest cocoon weight was found in Rompara, Meghalaya Slot-1.
- Shell ratio % was highest in Wokha, Nagaland Slot-1 (9.85%). Highest avg filament length was found in Jorhat, Assam Slot-1 (469.01m). Highest filament weight was found in Jorhat, Assam Slot-1 (0.27m). Lowest denier was found in Jorhat, Assam Slot-1 (5.20). Highest raw silk recovered in Jorhat, Assam Slot-1 (61.67%). The data shows that average Maximum Temperature highest in Rompara, Meghalaya (31.26 °C). Average Minimum Temperature highest in Rompara, Meghalaya (25.77 °C). Relative humidity highest in Rompara, Meghalaya (86.39%) Rainfall (Precipitation) highest in Rompara, Meghalaya (13.08 mm) whereas lowest in Wokha, Nagaland (6.03 mm).
- Muga silkworm rearing in cooler regions viz. Wokha, Nagaland and Rompara, Meghalaya has been carried out to prepare good quality DFLs for commercial rearing in Sep-Oct season. The results of this study showed that the rearing performance during summer season in cooler regions was significantly better than the rearing of Rompara, Meghalaya where adverse climatic conditions had to be faced during the summer season. An average 25% increase in cocoon yield was observed in cooler regions compared to warmers region. Cocoon yield, ERR and pupation % were highest in Som farm, Wokha district of Nagaland. Therefore, this farm in Wokha may be utilized for summer rearing for seed production. In general, the cocoon yield and all the other parameters of cooler zones rearing were remarkably higher than the farm rearing of CMER&TI, Lahdoigarh. Temperature, Humidity and also Rainfall directly affect the biological activities of the muga silkworm. Hence, an alternative, organized strategy for obtaining good quality seed material so that farmers will get good yield during the commercial season.
- During the period a total of 3690 Muga seed cocoons were subjected for 42 days preservation in the cold storage from 22.05.2022 to 03.07.2022 were released on 03.07.2022. The moth emergence was started from 11th July to 17 July 2022 and Grainage operation was conducted till hatching. It was observed that the total of 3143 (85.18%) moths were emergence and 252 (6.83%) moths were healthy moths and 2891 (78.35%) were cripple moths. However, the moths are weak and wings are not properly spread and could not use for coupling purpose. Therefore, it was unable to prepare dfls and the eggs are also depressed and unfertilized. The un-emerged cocoons were 547 (14.82%). Details observations are presented in the table:1. Remarks: As per experiment conducted at Muga Grainage, CMER & TI. It was observed that the Muga seed cocoon preservation technique for 42 days during summer season may not be feasible for commercial egg production.

Sl	**Duration of moth emergence period (7 days)**							**Total number of moth mergence**			**Coupling obtained**		
	Period	**Healthy moths**			**Cripple moths**								
		M	**F**	**Total**	**M**	**F**	**Total**	**M**	**F**	**Total**	**Natural**	**Mechenical**	**Total**
1	1st day	5	2	7	15	11	26	20	13	33	1	-	**1**

2	2nd day	20	15	35	603	159	762	623	174	797	7	-	**7**
3	3rd day	65	42	107	480	330	810	545	372	917	13	2	**15**
4	4th day	35	42	77	376	408	784	411	450	861	3	-	**3**
5	5th day	8	10	18	171	262	433	179	272	451	1	-	**1**
6	6th day	3	5	8	21	55	76	24	60	84	1	-	**1**
	Total	**136**	**116**	**252**	**1666**	**1225**	**2891**	**1802**	**1341**	**3143**	**26**	**2**	**28**
				6.83 %			**78.35 %**	**48.83 %**	**36.34 %**	**85.18 %**			

Moth emergence after 42 days

Cripple moths

Cripple moths

3800 Kesseru (HF-008 & HF-005) seedlings were distributed to 27 Eri farmers in Sivasagar area.

500 Borpat seedlings were distributed to three farmers.

77 kg Castor (NBR) seeds distributed for systematic showing for 137 eri farmers in Assam.

जैव-प्रौद्योगिकी विभाग
BIOTECHNOLOGY DIVISION

CONCLUDED PROJECTS:

Project Code and Title	**:**	**AIT-05016-MI - Integrating genomic and transcriptomics resources for functional insight into the biology of muga silkmoth Antheraea assamensis.**
Project Period	**:**	01-01-2021 to 31-12-2022
Funding Agency	**:**	Central Silk Board, Ministry of Textiles.
Total Budget Allocation	**:**	69.67 lakh (44.60 CMER&TI + 25.07 SBRL)
Total Expenditure (During the year)	**:**	2.98 Lakh (CMER&TI)
Scientist Involved	**:**	Dr. Arun Kumar K. P

Objectives

I. Development of web accessible database 'Mugabase' to host the muga sequence data, initially within CSB and later for public access.
II. Refining of assembly and annotation of the whole genome and transcriptome sequence data.
III. Identification and validation of functional genes associated with insect behavior, silk quality and immunity.

Summary of the achievements:

Vanya Silkbase: The development of the "Vanya Silkbase" has been successfully completed. The database can be accessed at https://vanyasilkbase.cmerti.res.in (Figure 1 and 2).

Genome, Transcriptome, and Proteome Annotation: The annotation of the genome, transcriptome, and proteome has been completed. The process of gene identification and functional annotation was carried out, leading to the identification of candidate genes related to silk character.

Synteny Analysis: A synteny analysis with the Bombyx mori genome has been completed, providing valuable comparative genomic insights.

Gene Validation: A total of 20 genes were selected for validation. The semi-quantitative validation of these genes has been successfully completed.

SNP Detection: Approximately 0.5 million SNPs have been detected in the wild type and cultivar muga genome. This rich source of genetic variation will be invaluable for future studies and breeding efforts.

Immunity-Related Genes: Functional genes associated with immunity have been identified. This could potentially lead to the development of disease-resistant strains.

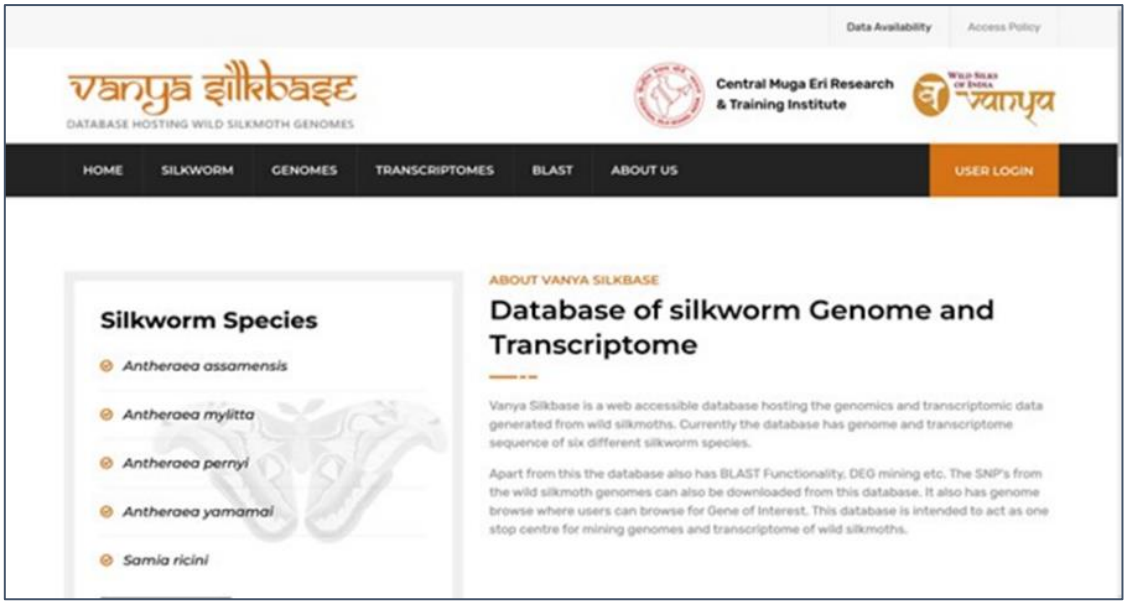


Figure 1: Screenshot from the Homepage of Vanya Silkbase

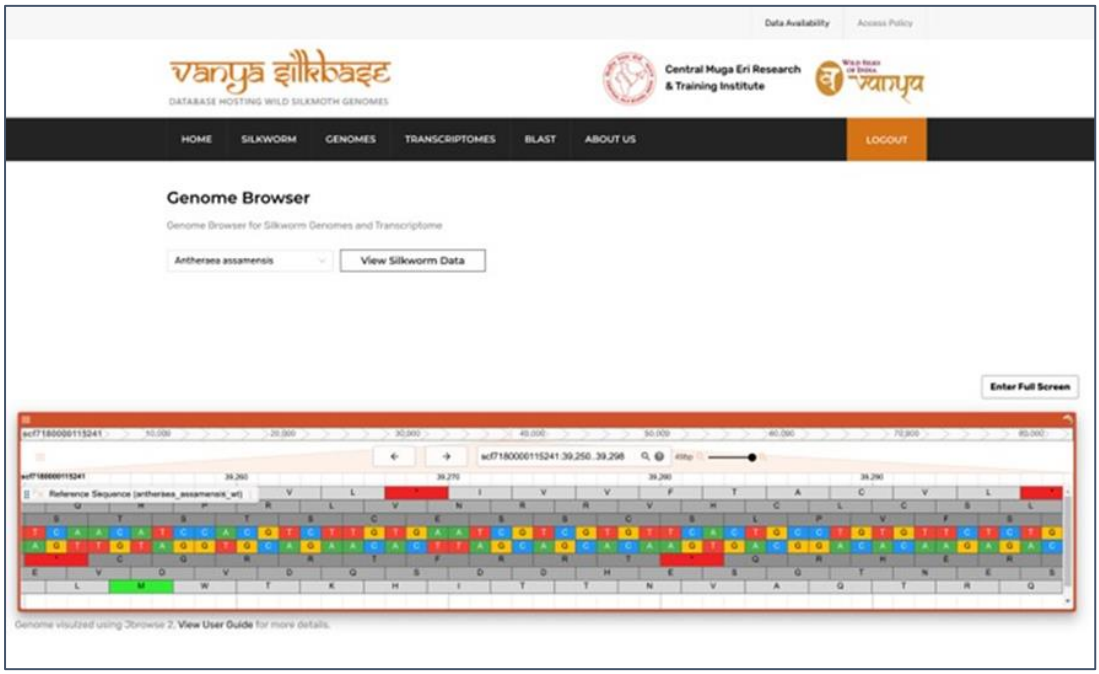


Figure 2: Genome viewer visualizing genome of Antheraea assamensis

<u>Project Code and Title</u> : AIT-05011-EF: Molecular Investigation into the Lignocellulolytic System of a Few Wild Silkmoth in North-East India.

Project Period	:	September, 2019 to September, 2022
Funding Agency	:	Central Silk Board, Ministry of Textiles.
Total Budget Allocation	:	46.32 Lakhs
Total Expenditure	:	6.52 Lakhs

(During the year)

Scientist Involved : Dr. Arun Kumar K.P.
Dr. Rajal Debnath
Dr. Dip. K. Gogoi.

Objectives:

I. Impact of Host plant range on the microbial community in Antheraea assamensis Helfer and Samia ricini Donovan.
II. Lignocellulose degradation by the gut microbes associated with Antheraea assamensis Helfer and Samia ricini Donovan.
III. Molecular characterization of the lignocellulolytic biomass degrading enzyme.

Summary of the findings/achievements:

Genome sequencing of potential isolates:

Potential degrader strains (SB6, LP10, GB3, MS29 etc) were further sequenced to understand the genetic basis of degradation. The genomes were whole genome sequenced using Illumina chemistry. The reads were pre-processed for quality, filtered and assembled & annotated (Figure 1).

CAZy Annotation of LP10 for presence of genes involved in catalysis of cellulose, xylan, lignin was performed. The CAZy database describes the families of structurally-related catalytic and carbohydrate-binding modules (or functional domains) of enzymes that degrade, modify or create glycosidic bonds.20 extracellular secreted enzymes classified as GH, CE, CBM identified by 3 different tools (HMMER, dbCAN_sub, dbCAN).

Overall, we characterized the microbiome of muga and eri silkworm comprehensively, which provided us with the identity of the most abundant flora that inhabits the silkworm's gut. Also, we could observe how diversity changes with feed plant species and how agricultural management practices like pruning and pollarding could impact the colonization of gut of silkworms with less diverse microbes which can impact their overall health and immune capacity in adverse environmental conditions. The study also presented us with microbial strains with potential lignocellulose degradation ability which was one of the important target objectives in the project. Strains SB6, LP10 belonging to Bacillus cereus LP10 and Paenibacillus xylanilyticus SB6 were promising and will have commercial utility and application. We could also harness one strain of Enterobacter munditis from muga silkworm gut which is reported in literature to have probiotic beneficial impact and isolated from honeybee gut.

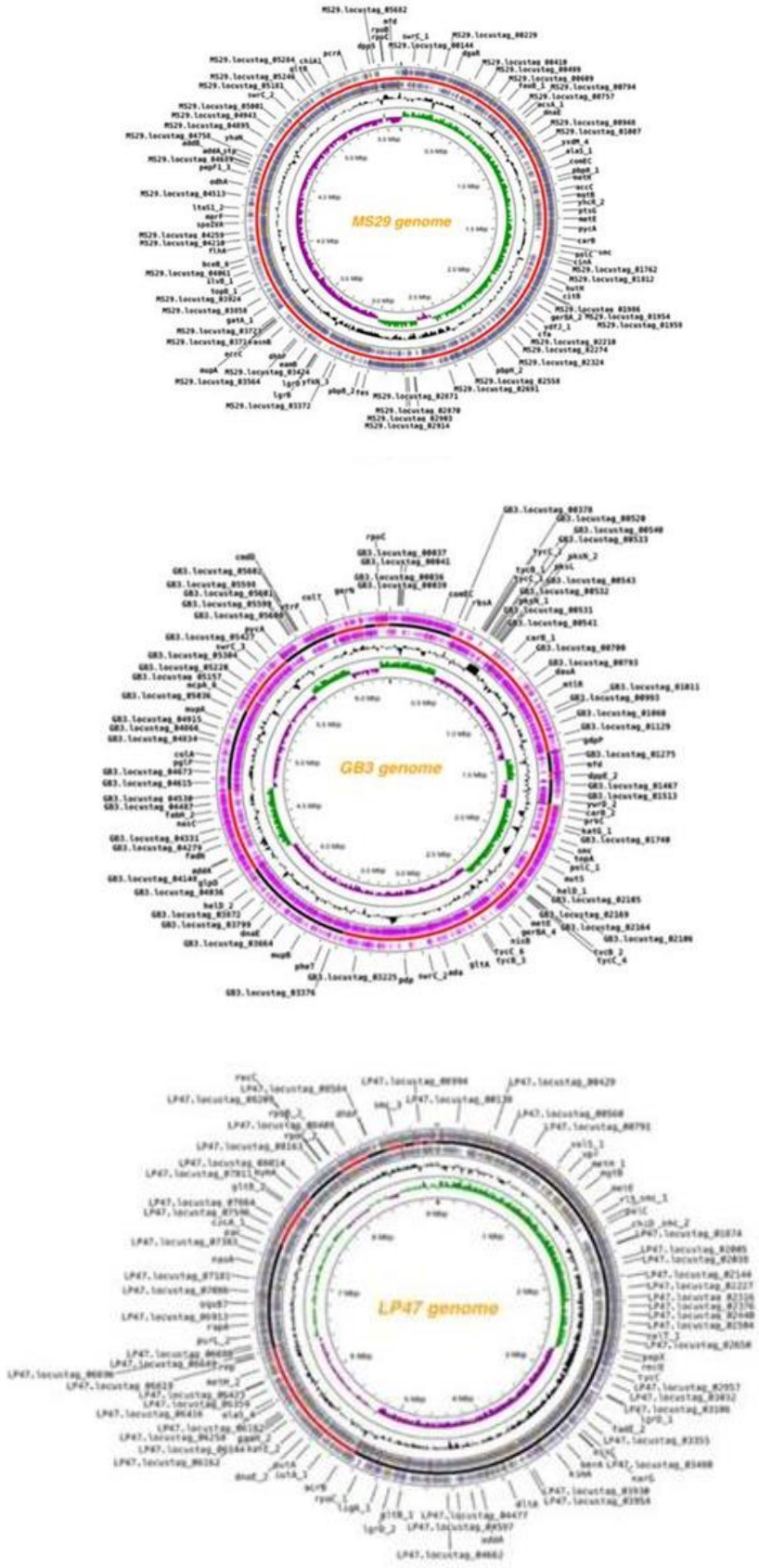


Figure 1: Genome maps of MS29, GB3 and LP47 strains

रेशम उत्पादन विस्तार, आर्थिक और प्रबंधन विभाग

SERICULTURE EXTENSION, ECONOMICS & MANAGEMENT DIVISION

CONCLUDED PROJECT:

Project Code: MOE05004EF (DST-07)
Project Title: Adoption of improved sustainable technologies of muga culture for elevation of cocoon production in the tribal belt of Assam

Project Period : August 2019 to July 2022 (Extended upto Feb 2023)
Funding Agency : Department of Science and Technology, New Delhi
Total Budget Allocation : Rs. 25,51,000 /-
Total Expenditure (During the year) : Rs. 12,73,600 /-
Scientist Involved : Dr. Vijay N, PI
Dr. D. Mech, CI
Dr. D.K. Gogoi, CI
Dr. S.A.S Rahaman, CI
Dr. Sathyanarayana, K, CI

Objectives:

1. To promote adoption of improved Muga rearing technologies among tribal rearers through sustainable NGO-rearer linkages facilitated by CMER&TI, Lahdoigarh
2. To improve the socio-economic status of tribal population by
3. enhancing cocoon production through improved muga culture.

Summary of the findings/achievements:

- There are 3 nos of Awareness program has been conducted at Lakhimpur, Laimekuri, Dhemaji and Boko, Kamrup districits and around 155 nos of farmers were participated in the programs. A Training program on Muga Silkworm seed production has been conducted at Lakhimpur consists of 10 nos of farmers. A Technology demonstration program on control of stem border
- was conducted at Jonai, Dhemaji participating around 40 nos of farmers
- Distribution of inputs like nylon net, foot sprayer, Chainsaw, DFls, Sodium hypochlorite and lahdoi to the beneficiary farmers for rearing and grainage activities
- Prepared demo videos of improved technology like pollarding of host plants, pre brushing care, improved bamboo mountage and plastic mountage, pre brushing care, different stages of muga silkworm, transfer of muga silkworms, collection of mature muga silkworm, post cocoon technology, hatching and initiating to prepare success story of muga farmers from study area
- Farmers from Jonai, Dhemaji district were harvested 80,000 nos of cocoons from 1Kg DFLs in the year 2022 under the DST project code MOE05004EF.
- The average knowledge level was increased to 26.43% from benchmark survey (32%) to mid survey (40.46%)
- Overall adoption range was significantly increases from benchmark Survey (10.5%) to mid survey (13.5%)

Figure 1: Awareness program and distribution of Foot sprayer and Inputs at Dhekiajuli, Lakhimpur on 30-09-2021

Figure 2: Training program on Muga Silkworm seed production at Lakhimpur from 21-04-2021 to 23-04-2021

Figure 3: Farmers were harvested 80,000 nos of cocoons from 1Kg DFLs at Jonai, Dhemaji

Table: Knowledge and Adoption level of improved technologies of Muga culture of the Beneficiary farmers

Sl. No	Name of technologies	Knowledge				% increases	Adoption				% increases
		Benchmark survey		Mid survey			Benchmark survey		Mid survey		
		No. of farmers	(%)	No. of farmers	(%)		No. of farmers	(%)	No. of farmers	(%)	
1	Spacing of host plants	67	33.5	87	43.5	29.85	26	13	28	14	7.69
2	Application FYM and NPK	17	8.5	52	26	205.88	13	6.5	14	7	7.69
3	Intercropping	71	35.5	101	50.5	42.25	53	26.5	57	28.5	7.55
4	Pruning schedule	31	15.5	47	23.5	51.61	17	8.5	19	9.5	11.76
5	Control of stem borer	59	29.5	89	44.5	50.85	12	6	14	7	16.67
6	Mother moth examination	29	14.5	29	14.5	0.00	0	0	0	0	0.0
7	Egg surface sterilization	37	18.5	39	19.5	5.41	17	8.5	18	0	5.88
8	use of dfls	81	40.5	105	52.5	29.63	37	18.5	40	20	8.11
9	Pre brushing care	93	46.5	106	53	13.98	21	10.5	25	12.5	19.05
10	Early stage rearing	115	57.5	123	61.5	6.96	34	17	38	19	11.76
11	Lahdoi	41	20.5	91	45.5	121.95	0	0	41	20	High
12	Biological control of uzi fly	12	6	16	8	33.33	0	0	0	0	0.0
13	Improved mountage	36	18	40	20	11.11	0	0	28	14	High
14	Selection of seed cocoon	110	55	130	65	18.18	47	28.5	49	24.5	4.26
15	Disinfection of rearing field	89	44.5	98	49	10.11	34	17	38	19	11.76
16	Disinfection of rearing appliance	131	65.5	142	71	8.40	21	10.5	24	12	14.29
	Average	64	32	81	40.46	**26.43**	21	10.5	27	13.5	**28.57**

REGULAR ACTICTIVITIES UNDER EXTENSION COMMUNICATION PROGRAMMES CONDUCTED DURING THE YEAR 2022-23

Organization of vanya reshom krishimela

The Vanya Reshom Krishimela of CMER&TI, Lahdoigarh for the year 2022-23 was organized on 10th January 2023 at Chapakhowa, Sadiya in Tinsukia district of Assam. More than 500 eri and muga farmers, entrepreneurships, officers and officials of sericulture department of Assam, scientists, technical & administrative staffs of CMER&TI were participated in the Krishimela. Dr. K. M. Vijaya Kumari, Director, CMER&TI, CSB, Lahdoigarh was chaired as the Chairperson of the inaugural session of the Krishimela. Shri S. Das, ACS, Assistant Commissioner, Sadiya Sub Division was the Chief Guest and Shri K. Gupta, Assistant Director of Cottage Industry & Commerce, Sadiya was the Special Guest in the occasion. Besides, Shri Lohit Gogoi, Chief Adviser, Bihu Suraksha Sammittee, Assam, Shri Jatin Gogoi, Principal, Sadiya H.S. School and Shri Nabin Gogoi, Supdt. of Sericulture, Sadiya was present as Guests of Honour in the inaugural session. An exhibition was arranged to display on recent technologies and different products of vanya silk in the occasion. Many of the local entrepreneurships along with their unique products of vanya silks were also participated in the exhibition. The exhibition was inaugurated by Shri S. Das, ACS, Assistant Commissioner, Sadiya Sub Division who was the Chief Guest of the occasion.

In the Technical Session, ***"Improved technologies of Muga & Eri culture"*** were demonstrated by the concerned scientists through multimedia projector. After demonstration of technologies, a fruitful interaction session between scientists of the institute and farmers was held. Various problems viz, scarcity of muga and eri seeds on time, nonhatching of dfls, incidence of pest and diseases of silkworms, marketing of cocoons & products, etc were discussed and necessary remedial measures were suggested during the session.

Organization of technological workshop

Central Muga Eri Research & Training Institute, Lahdoigarh has organized a technological workshop on "**Pest and Disease Managemrent of Muga and Eri Silkworms**" at the institute premises on 7th March 2023. Dr. K. M. Vijaya Kumari, Director, CMER&TI, CSB, Lahdoigarh was chaired as the Chairperson of both the inaugural and technical session of the workshop. Prof. Dr. L.K. Hazarika, Retd. Head, Entom. Department and Prof. Dr. Ananta Saikia, OSD, College of Sericulture, Assam Agricultural University, Jorhat were graced the inaugural session as Special Guests. The scientists of MESSO, Guwahati, RSRS, Jorhat, Scientists & incharges of the nested units of CMER&TI, officers and technical staffs of DoS, Assam and more than 120 muga and eri farmers of different sericulture pockets were actively participated in the workshop. The aim of the programme was to educate the farmers about the advance techniques of pest and disease management of muga and eri silkworm and to provide remedial measures against different problems of sericulture for higher cocoon yield.

The inaugural session was followed by Technical Session where the improved techniques of pest and diseases management of muga and eri silkworms were presented by Dr. Arun Kumar, Scientist –D and Dr. Mahesh D.S, Scientist- C using the multimedia projector. After presentation of slides,

active interaction of the farmers was held on other problems of muga and eri culture and provided remedial measures on the problems accordingly. Dr. D. Mech, Scientist-D and Shri Bitupon Das, Scientist- D, Shri L. Sonowal, Scientist-C & Incharge, REC, Sile and other scientist of the institute were took part in the interactions hours.

EXTENSION COMMUNICATION PROGRAMMES CONDUCTED DURING THIS YEAR

#	Name of the Programme	Target for the year 2022-2023			Achievement for the year 2022-2023		
		Physical (No)	Beneficiaries (No)	Financial (Rs. in lakh)	Physical (no)	Beneficiaries (No)	Financial (Rs. in lakh)
1	**Krishimela/ Reelers Mela-cum-Exhibition**						
	CMER&TI, Lahdoigarh	1	400	2.50	1	552	2.50
	RSRS Boko	1	200	1.25	1	200	1.25
	RSRS, Imphal	1	200	1.25	1	164	1.25
Sub-Total		**3**	**800**	**5.00**	**3**	**916**	**5.00**
2	**Farmers Field days**						
	RSRS Boko	4	280	0.60	4	304	0.60
	RSRS, Imphal	4	280	0.60	4	326	0.60
Sub-Total		**8**	**560**	**1.20**	**8**	**630**	**1.20**
3	**Awareness programmes**						
	RSRS Boko	4	200	0.40	4	301	0.40
	RSRS, Imphal	4	200	0.40	4	310	0.40
	REC, Lakhimpur	5	250	0.50	5	260	0.50
	REC, Fatehpur.	5	250	0.50	5	254	0.50
	REC, Coochbehar	5	250	0.50	5	270	0.50
Sub-Total		**23**	**1150**	**2.30**	**23**	**1395**	**2.30**
4	**Tech. demonstrations/ Enlightenment Programmes**						
	RSRS Boko	4	80	0.04	4	290	0.04
	RSRS, Imphal	4	80	0.04	4	150	0.04
	REC, Lakhimpur	5	100	0.05	5	177	0.05
	REC, Fatehpur U.P.	5	100	0.05	5	304	0.05
	REC, Coochbehar	5	100	0.05	5	175	0.05

Sub-Total		**23**	**460**	**0.23**	**23**	**1096**	**0.23**
Workshops/Seminars & Conferences							
5	**CMER&TI, Lahdoigarh**	1	100	2.00	1	120	2.5
	RSRS Boko	-	-	-	-	-	-
	RSRS, Imphal	1	100	2.00	1	100	1.50
Sub-Total		**2**	**200**	**04.00**	**2**	**220**	**4.00**
Grand Total		**59**	**3170**	**12.73**	**59**	**4257**	**12.73**

Sl	**Name of the Programme**	**Target for the year 2022-2023**			**Achievement for the year 2022-2023**		
		Physical (No)	**Beneficiaries (No)**	**Financial (Rs.in lakh)**	**Physical (no)**	**Beneficiaries (No)**	**Financial (Rs. In lakh)**
1.	Krishimela/ Reelers Mela-cum-Exhibition	3	800	5.00	3	916	5.00
2.	Farmers Field days	8	560	1.20	8	630	1.20
3.	Awareness programmes	23	1150	2.30	23	1395	2.30
4.	Tech. demonstrations / Enlightenment Programmes	23	460	0.23	23	1096	0.23
5.	Workshops/Seminars & Conferences	2	200	4.00	2	220	4.00
6.	Exhibition	-	-	-	3	-	-
	Grand Total	**59**	**3170**	**12.73**	**62**	**4257**	**12.73**

CAPACITY BUILDING AND TRAINING PROGRAMMES FOR FINANCIAL YEAR OF 2022-2023

#	Name of the Training Programme	Target		Achievement	
		Physical	**Financial**	**Physical**	**Financial**
1	Exposure visit for Technology Awareness	-	-	-	-
2	Farmers' Skill Training	**19**	**21.38**	**19**	**19.02**
3	Technology Orientation Programme (Officials from DoS & CSB)	**10**	**9.50**	**10**	**8.89**
4	Training under Post cocoon sector	**6**	**5.40**	**6**	**4.86**
5	Training under Sericulture Resource Centre	**45**	**1.80**	**45**	**1.60**
6	Training under STEP by Institute	1	0.32	2	0.52
	Sub Total	**81**	**38.40**	**82**	**34.89**
7	Training funded under - NON-CBT	**-**	**-**	**1**	0.62
8	Training funded under - NON CSB	-	-	2	-
9	Training under SAMARTH	5	14.19	3	9.17
	Sub Total	**5**	**14.19**	**6**	**9.79**
	Grand Total	**86**	**52.59**	**88**	**44.68**

अधीनस्थ इकाइयाँ की गतिविधियाँ
ACTIVITIES OF NESTED UNITS

REGIONAL SERICULTURAL RESEARCH STATION (RSRS), IMPHAL, MANIPUR

- Executing four research projects funded by CSB and DBT and progress achieved are as per milestone. Three collaborative mulberry-based projects are also being carried out in the station.
- Produced 27,473 dfls with 82.00 % achievement and supplied to State govt. and ASRs for further multiplication during spring crop 2023.
- In the silkworm GPB, three species of Oak tasar silkworm *A. proylei*, *A. pernyi*, *A. frithi* and 9 evolved breeds, three eco-races of eri and muga silkworm are being maintained. In host plant GPB, all the primary food plants of oak Tasar, eri, muga & mulberry are being maintained.
- Five ToTprogrammes on Oak Tasar culture were conducted and achieved improvement in productivity against control.
- Conducted 9 (nine) nos. training programme on Farmers skill training, Technology Orientation Programme and Post Cocoon technology in sericulture.
- Published 5 (five) nos. of research paper in scientific journals (International) and 5 (five) nos. of abstract in abstract book of International and National Seminar.
- Published 1 (one) bilingual booklet on diseases and its management in oak tasar culture and 1 (one) booklet on Package of practices in Eri culture in local language.
- A total of 4000 kg of vermicompost were prepared during the year and applied in the field of RSRS, Imphal.
- A Sericulture Krishi Mela was organised on 31.01.2023 at RSRS, Imphal campus to popularize the latest technologies of four different types of sericulture among farmers and attended by 200 stakeholders.
- A workshop on Oak Tasar Culture was organised on 10.03.2023 at Dehrahdun and attended by Director and officials from CMERTI, Lahdiogarh, Director and officials from CTR&TI, Ranchi, DOS officials from North West, entrepreneurs, Reelers, weavers representatives etc.
- Under ECP: Conducted 4(four) nos. field day, 4 (four) nos. awareness programme, 2 (two) group discussion and sensitized 760 stakeholders during the year 2022-23.
- DCB realization**:** In the year 2022-23 a sum of Rs. 1,50,938/- was received towards sale of oak Tasar dfl, eri dfl, muga dfl and sale proceed of pierced cocoons.
- Conducted Hindi workshop on quarterly basis and Hindi Pakhwada (fortnight) from 16th to 30th September, 2023.
- Conducted various cleanliness drives under Swachh Bharat Abhiyan on 2nd October, 2023.
- Observed Swachhata activites by RSRS, Imphal regularly to maintain a clean environment.

CONCLUDED PROJECTS:

Project Code: APR 05008SI

Project Title: Standardization of Rearing and Grainage technology of *Antheraea frithi* Moore.

Project Period	: October, 2019 - September, 2022
Funding Agency	: Central Silk Board, Bangalore
Total Budget allocation	: Rs.12.85
Total expenditure (during the year)	: Rs. 94,779
Scientists involved	: Dr. L. Somen Singh, RSRS, Imphal, PI Dr. S. Subharani, RSRS, Imphal, CI

Objective:

1. To standardize the rearing and grainage technologies to suit for commercial adoption.

Summary of the findings/ achievements:

- During 1stcrop, Antheraea frithi moths started emergence after undergoing 138-150 days of pupal diapause.
- Natural coupling of moths obtained about 51 % inside the bamboo basket covered with black cloth.
- Recorded77 to 80% hatching when the moths were allowed for 14 hrs of coupling.
- Highest average fecundity of 194 observed in bamboo monia followed by nylon bag of 190 eggs.
- Chawki rearing conducted in indoor condition by using L. dealbata, Q. serrata and Q. grifhithi twigs. After chawki, adult rearing was conducted in outdoor by feeding the above mentioned three different food plants and it is observed that the worms reared on L. dealbata showed the highest cocoon yield of 42 cocoons per dfl.
- During 2nd crop grainage 80% emergence of moths and 50% natural coupling of moths obtained inside the bamboo basket covered with black cloth.
- Recorded 76 to 80 % hatching when the moths were allowed for 14 hrs coupling.
- Chawki rearing in indoor condition followed by outdoor rearing by feeding L. dealbata, Q. serrata and Q. griffithi leaves recorded higher cocoon yield of 40 cocoons per dfl in L. dealbata fed worms.
-

Project Code: APR 05010SI

Project Title: Evaluation of eri silkworm races suitable for different agro-climatic conditions of Manipur

Project Period	: October, 2019- September, 2022
Funding Agency	: Central Silk Board, Bangalore
Total Budget allocation	: Rs. 11.80 lakhs
Total expenditure (during the year)	: Rs. 6.459 lakhs
Scientists involved	: Dr. Y. Debaraj, RSRS, Imphal, PI Dr. L. Somen Singh, RSRS, Imphal, CI

Objective:

1. To identify the best performing eri silkworm race in different agro-climatic conditions of Manipur.

Summary of the findings/achievements:

- Highest fecundity and ERR% were recorded in Borduar (421 eggs, 89.04 % in autumn) followed by C-2 breed (413 eggs, 87.40 %) among the eco-races in low altitude.
- Similarly, in high altitude highest fecundity and ERR% were recorded in Borduar (410 eggs & 80.01%) followed by C-2.
- Cocoon parameters were also observed highest in Borduar followed by C-2 in all the seasons.
- Among the strains, YP and GBP showed better performance than others in all economic parameters.
- Highest fecundity and ERR% was recorded in Yellow plain (417 eggs, 93.11% in autumn) followed by Greenish blue plain (413 eggs and 93.26% in autumn crop.
- Cocoon parameters were also observed highest in Yellow plain followed by Greenish blue plain.
- Among the crops, autumn crop was found better followed by spring crop in terms of rearing and other economic characters.

ONGOING PROJECTS:

Project Code: AIB 05009SI

Project Title: Isolation of thermotolerant line (s) of oak tasar silkworm *Antheraea proylei* J.

Project Period	: October, 2019 to September, 2022 (Extended upto Sept. 2023)
Funding Agency	: Central Silk Board, Bangalore
Total Budget allocation	: Rs.16.90 (Rs.21.90 in revised)
Total expenditure (during the year)	: Rs. 8.178 lakhs
Scientists involved	: Dr. Y. Debaraj, RSRS, Imphal, PI Dr. S. Subharani, RSRS, Imphal, CI Dr. Arun Kumar KP, CMER&TI, CI

Objectives:

- To isolate thermo-tolerant line of oak tasar silkworm, *Antheraea proylei*
- Characterization of Heat shock protein gene in thermo-tolerant line.

Summary of the findings/achievements :

- Seed cocoons of thermal stress induced at different temperature regimes (32, 35, 38 ^{o} C). and control lots of *A. proylei*, RTRS-1 and C27 are under preservation for continuing the generation.
- Protein profiling studies of heat induced cocoons of *A. proylei*, RTRS-1 and C27 showed six major proteins bands which are having high molecular weight to be expressed differentially (increased or decreased) after heat was induced at different temperature.
- These proteins were further identified by amino acid sequencing as HSP 19.9, 21, 60 and 90 which increase or decrease depending on temperature regimes.

- Genomic DNA isolation from A. *proylei*, RTRS-1 and C27 for development of SCAR marker in Department of Biotechnology, Manipur University. PCR amplification of random segments of genomic DNA (RAPD) using 20 different decamers is under progress.
- Presented a paper entitled " Differential expression of heat shock proteins in temperate tasar silkworm, *Antheraea proylei* Jolly (Saturniidae: Lepidoptera) in the ISC congress held at Romania.

Analysis of transcript expressions of Heat Shock Proteins:

Antheraea proylei: Total RNA was isolated from the silk glands of the heat-treated larvae using Trizol reagent. RNA was quantified using Spectrophotometer. 1 ug each of the total were reversed transcribed into 1st strand cDNA.

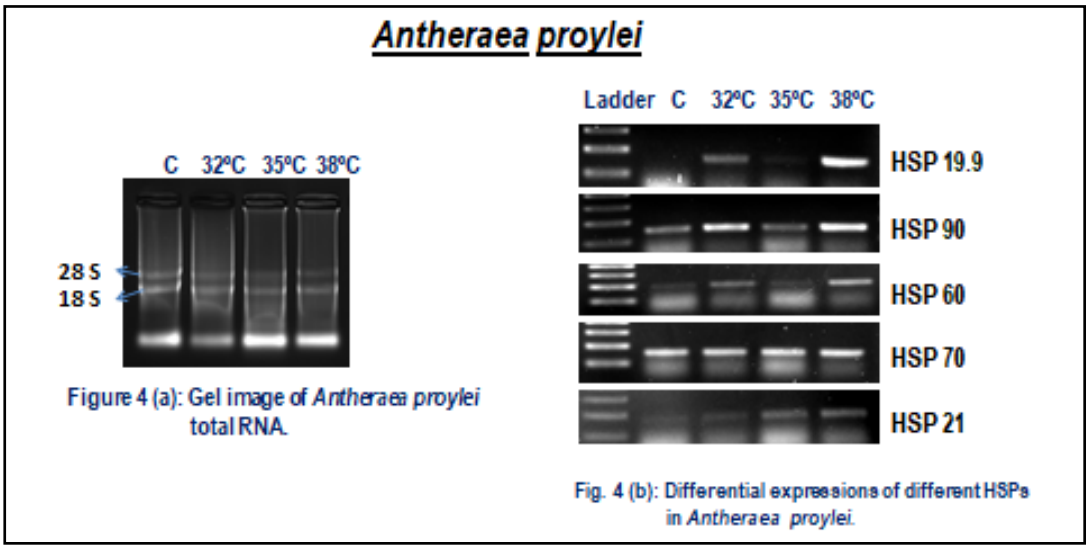


Figure 4 (a): Gel image of *Antheraea proylei* total RNA.

Fig. 4 (b): Differential expressions of different HSPs in *Antheraea proylei*.

- Expressions of HSP 19.9, HSP 90 and HSP 60 initially increase at 32ºC but decrease at 35ºC then further increase at 38ºC.
- Expression of HSP 70 was not significant. Expression of HSP 21 increases with increase in temperature.
- Highest expression of HSP proteins were found at 38ºC compared to control.
- Therefore, HSP 19.9, HSP 21, HSP 60 and HSP 90 are the HSPs which are responding to the thermal stress.

RTRS-1

- Expression of HSP 19.9 was not observed.
- Expressions of HSP 60 and HSP 90 decrease at 32◦C but further increase with
- increase in temperature.
- No significant differences were found in the expression of HSP 70 protein.
- Expression of HSP 21 increases with increase in temperature.

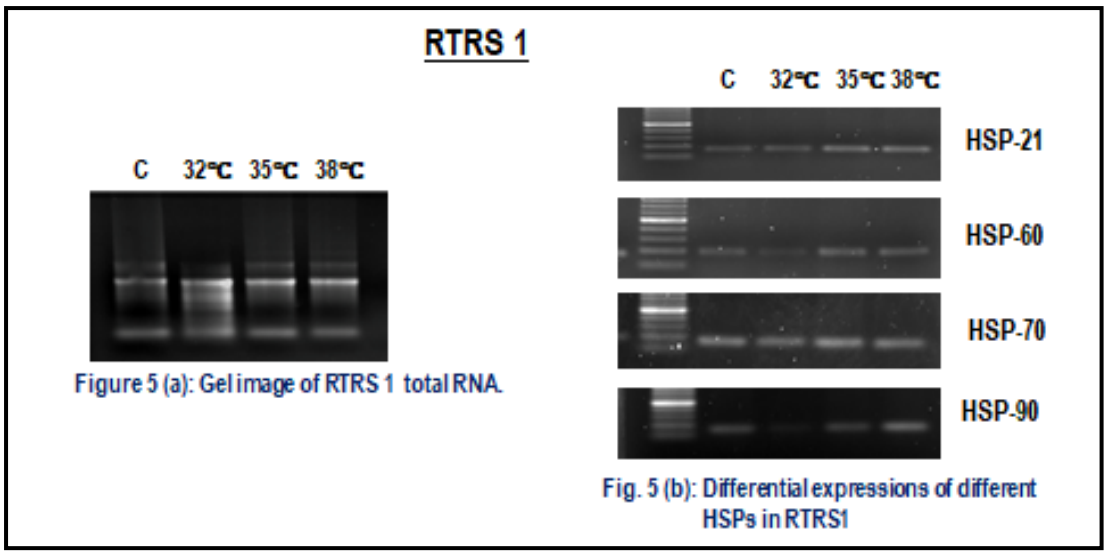


Figure 5 (a): Gel image of RTRS 1 total RNA.

Fig. 5 (b): Differential expressions of different HSPs in RTRS1

C27

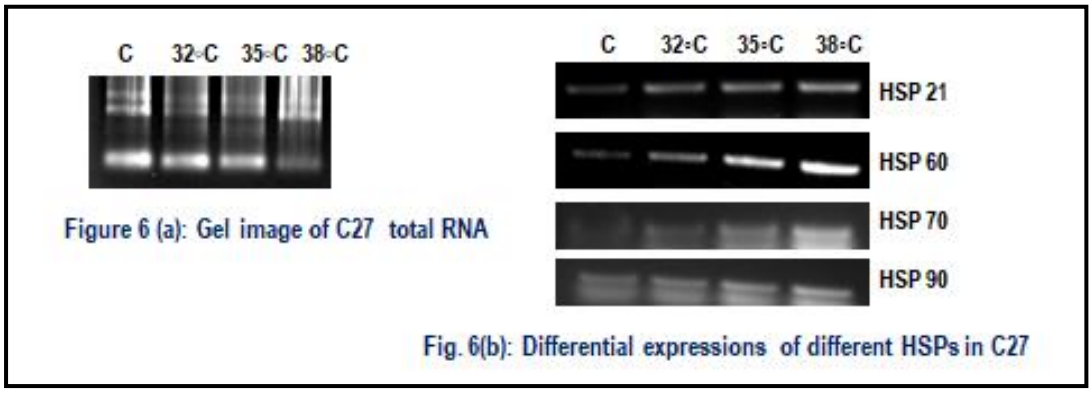


Figure 6 (a): Gel image of C27 total RNA

Fig. 6(b): Differential expressions of different HSPs in C27

- Expression of HSP transcripts increase with increase in temperature.
- Expression of HSP 19.9 was not observed.
- Significant increase in the expressions of HSP 21 and 60 with increase in temperature.

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
Total expenditure (during the year)	: Rs. 0.748 lakhs
Scientists involved	: Dr. S. Subharani Devi, RSRS, Imphal, PI Dr. Y. Debaraj, RSRS, Imphal, CI

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 4 (four) *Antheraea sp*. from different host plants belonging to the family saturniidae and four genera from different NE states and the morphometrics data indicated that the cocoons of *A. proylei, A. frithi* and *A. mylitta* are single layered whereas ithe cocoons of *A. roylei* is double layered. The filament length of *A. proylei, A. frithi* and *A. mylitta* cocoons are at par with each other whereas it is lowest in *A. roylei*.

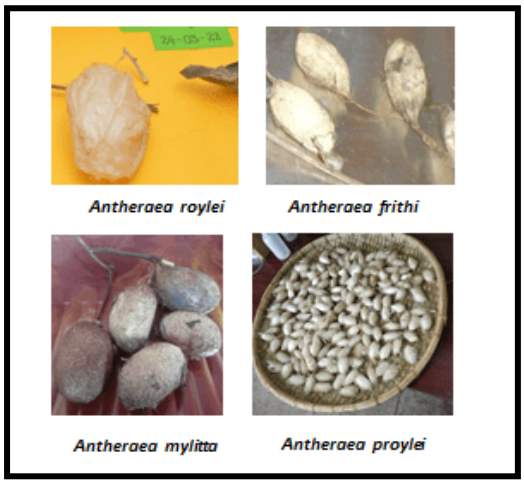


Fig. 1.: Cocoons of different *Antheraea* sp. collected from NE states

Table 1. List of *Antheraea* species and their food plants collected from NE states

SL. NO	SCIENTIFIC NAME	HOST PLANTS	DISTRIBUTION
1	*Antheraea roylei*Moore	*Q. serrata* & *L. dealbata*	Manipur (Senapati, Churachandpur, Bishnupur)
2	*Antheraea frithi*Moore	*Q. serrata* & *L. dealbata*	Manipur (Senapati, Churachandpur & Bishnupur), Arunachal Pradesh.
3	*Antheraea mylitta*	*Lagerstroemia speciosa*	Manipur, Assam, Nagaland
4	*Antheraea proylei*	*Q. serrata, Q. griffithi* & *L. dealbata*	Manipur, Assam, Nagaland, Meghalaya, Mizoram

Surveyed and collected semi domesticated population of *Antheraeaproylei*from different states of North East and recorded the morphometric characteristics.

Fig. 2: *A.proylei* cocoons collected from different NE states

Table 2: Cocoon sizes in different population of *A. proylei*collected from NE states

State	Length (cm)	Breadth (cm)	Length/ Breadth Ratio	STDEV (±)	CV (%)
Assam	3.88	2.06	188.38	2.44	1.29
Manipur	4.14	2.08	199.09	2.03	1.02
Meghalaya	3.84	2.04	188.28	5.41	2.87
Mizoram	3.82	2.20	173.69	5.49	3.16
Nagaland	3.66	2.02	181.27	5.20	2.87

Samples of different *Antheraea* sp. collected during survey are sent to other collaborating Institutes for molecular level characterization and cocoons of *A.proylei* to other collaborating institutes for GC-EAD studies.

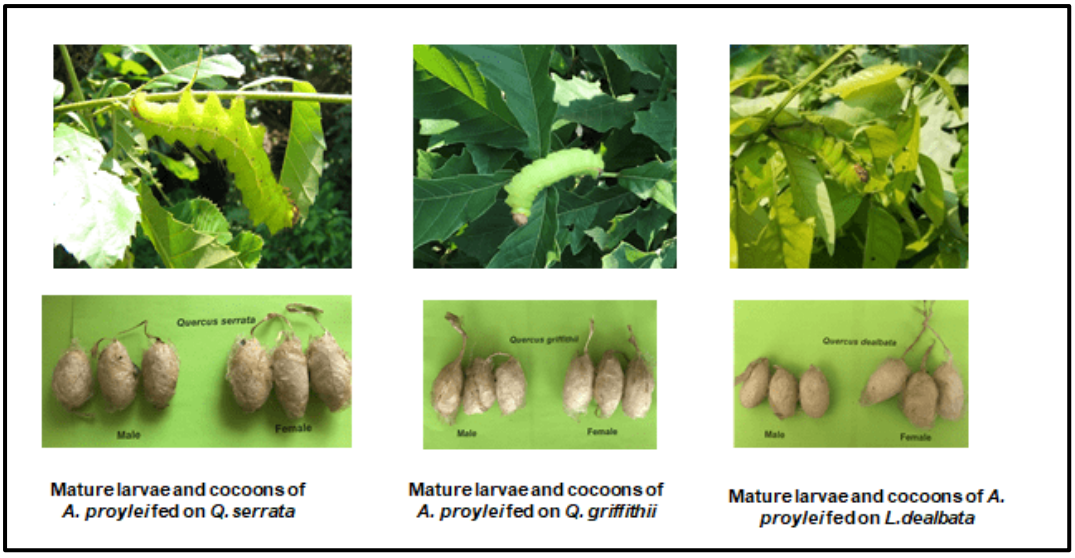


Fig 3. Matured larvae and cocoons of *Antheraea proylei* reared on different food plants

1. **Conducted *A. proylei* rearing on different food plants studied the rearing performance in different seasons.**

Table 3: Comparative rearing performance of *Antheraea proylei* during spring and autumn crop in different host plants

Sl.No.	Food Plant	Season					
		Spring			Autumn		
		Larval weight (gm)	Total larval duration (days)	ERR (%)	Larval wt.(g)	Total larval duration (days)	ERR (%)
1	*Q. serrata*	22.39 ±0.93	33 ± 0.82	42.05 ±0.69	23.10 ±0.16	38 ± 0.65	27.27 ± 0.89
2	*Q. grifithii*	19.12 ±0.16	34 ± 0.71	40.96 ±1.61	18.91 ±0.80	39 ± 0.24	25.75 ± 0.73
3	*L. dealbata*	12.90 ±0.69	40 ± 1.63	38.00 ±0.81	16.19 ±0.04	43 ± 0.98	14.53 ± 0.01
	S.Ed. (±)	0.66	0.10	0.73	0.52	0.37	0.81
	CD 0.05	1.88	3.15	2.08	1.50	1.07	2.33

Table 4: Economic parameters of *A. proylei* reared on different food plants during Spring and Autumn crop

Sl. No.	Food plant	Season					
		Spring			Autumn		
		Cocoon wt.(g)	Shell wt.(g)	Shell ratio (%)	Cocoon wt.(g)	Shell wt.(g)	Shell ratio (%)
1	*Q. serrata*	8.38 ±0.14	0.86 ±0.03	10.26 ±0.70	8.25 ±0.03	0.80 ±0.06	9.69 ±0.81
2	*Q. grifithii*	8.16 ±0.42	0.79 ±0.05	9.68 ±0.71	8.19 ±0.21	0.83 ±0.03	10.13 ±0.01
3	*L. dealbata*	7.10 ±0.14	0.63 ±0.01	8.87 ±0.42	7.01 ±0.01	0.60 ±0.04	8.55 ±0.32
	S.Ed (±)	0.86	0.04	0.19	0.12	0.03	0.40
	CD 0.05	0.30	0.13	0.54	0.35	0.09	1.16

The highest effective rate of rearing (ERR%) was observed in *Q. serrata* fed larvae (49.05 %), followed by *Q. griffithi* (44.96 %) and lowest was observed in *L. delbata* fed plants (38.00 %) during spring season. Though *A. proylei* fed well in all the three food plants, the growth of the larvae was retarded when fed on *L. dealbata*. The quality parametrs *viz*. single cocoon weight, shell weight and shell ratio was observed superior with *Q. serrata* as food plant than those fed with *Q. griffithi* and *L. dealbata*. Similar observation was also recorded

during autumn crop. The study showed that larvae feeding on favourable food plants have direct effect on the increase of growth rate, shorter larval duration and cocoon yield and its economic parameters during both the seasons.

Table 5: Ovipositional behaviour, egg and moth characters of *A.proylei* fed on different food plants

Sl. No	Characters	*Q. serrata*	*L.dealbata*	*Q. griffithii*
1	Effective fecundity(no)	174 ± 22.11	101 ± 4.49	156 ± 4.66
2	Av. Egg retained (no)	10± 6.11	20± 8.32	18 ± 3.51
3	Diameter of egg (mm)	3.0 ± 0.33	3.0 ± 0.33	3.0 ± 0.33
4	Eggs weight (mg)	8.0 ± 0.33	8.0 ± 0.33	8.0 ± 0.33
5	Hatching (%)	84.5 ±1.81	81.04 ± 1.66	83.7 ± 1.31
6	Moth weight (gm) (male)	1.33 ±0.25	0.75 ±0.12	1.09 ±0.11
7	Moth weight (gm) (female)	3.36 ±0.73	2.91 ±0.10	4.5 ±0.10
8	Wing span (mm) (m) (male)	122.0 ±3.6	118.33 ±5.6	118.33 ±5.60
9	Wing span (mm) (f) (female)	131.66 ±3.48	136.0 ±1.15	140.6 ±2.08

Studied the egg laying potential of *A. proylei* moths on five different food plants *viz*. *Quercus serrata*, *Quercus griffithi*, *Lithocarpus dealbata*, *Quercus incana* and *Quercus semicarpifolia*. After emergence *Antheraea proylei* moths were allowed to couple for eight hours and then decoupled moths were kept for egg laying till the 3rd day with the fresh leaves and also tied with Kharikas made from twigs of different host plants. After the 3rd day of egg laying the number of laid eggs and retained eggs in each moth were counted.

The egg laying potential of *A. proylei* moths on five different food plants showed highest realized fecundity with *Q. serrata* leaves (185 nos) followed by *Q. incana* (179 nos) and *L. dealbata* (178 nos) and the least was observed in control.

In case of twigs maximum realized eggs were also observed in *Q. serrata* (196 nos) followed by *Q. griffithi* (190 nos) and the least in control. The least retained eggs was also recorded in *Q. serrata* leaves (10 nos) and twigs (13 nos) during autumn crop grainage.

OTHER COLLABORATIVE PROJECTS: (Associated under CSR&TI, Berhampore)

Project Code: PIE 13001 MI

Project Title: All India Coordinated Experimental Trial for Mulberry (AICEM Phase-IV)

Scientists involved**:** Dr. Y. Debaraj, RSRS, Imphal, CI

Objective:

1. Identification of suitable mulberry variety for regional, zonal and national use based on their performance.

Summary of the findings/achievements:

Five mulberry varieties, viz., C-1360, AGB-8, PPR-1, C-2038 and S-1635 are being maintained following agronomic practices. Plantation was raised from saplings supplied from CSR&TI, Berhampore. Plantation of five varieties done with six replications in RBD layout. Plants are being maintained as per programme schedule with required cultural practices along with gap filling. Nursery propagation studies already completed. Till date 7th times leaf yield already completed and raw data sent to CSR&TI, Berhampore for analysis (Three crops per year, i.e., Spring, Summer and Autumn). Silkworm rearing bioassay will be conducted from Autumn crop 2023 onwards. Now pruning of all the plantations have already been completed and cleaning/ cultural practices are under progress.

Project Code: PIE 02002 SI

Project Title: Evaluation of performance of mulberry genotype C9 under red and laterite soils.

Scientists involved **:** Dr. L. Somen Singh, RSRS, Imphal, CI

Objective:

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

Summary of the findings/achievements:

As per activities of the project recording of data on different plant growth parameters of the three genotypes have been collected and among the test genotypes, highest leaf yield was recorded in C9 with 39.95 kg per plot followed by C 2038 with 37.41 kg per plot. The raw data has been sent to CSR&TI, Berhampore for compilation.

EXTENSION ACTIVITIES

Capacity Building and Training:

Capacity Building and Training Institute-wise for financial year of 2022-2023					
		Target for the Year		Progress till end of the year	
#	Name of the Trg. Programme	Physical	Financial	Physical	Financial
1	Exposure visit for Technology Awareness	--	--	--	--
2	Farmers' Skill Training	5	5.625	5	5.625
3	Technology Orientation Programme (Officials from DoS& CSB)	2	1.8	2	1.8
4	Training under Post cocoon sector	2	1.8	2	1.8
5	Training under Sericulture Resource Centre				
6	Training under STEP by Institute				
	Sub Total				
7	Training funded under - NON CBT				
8	Training funded under - NON CSB				
	Sub Total				
	Grand Total	**9**	**9.225**	**9**	**9.225**

Meteorological Data:

Months	Criteria	Temperature (° C)		Relative humidity (%)	Rainfall (mm)	Rainy days (no.)
		Max.	Min.			
April, 22	Mean	28.40	11.96	67.36	79.6	9
	Range	22-31	7-20	44-92		
May, 22	Mean	27.73	17.13	75.98	176.11	15
	Range	20-30	15-22	50-92		
June, 22	Mean	29.01	20.04	73.88	165.81	14
	Range	29-31	18-25	52-92		
July,22	Mean	30.40	22.22	69.34	84.02	8
	Range	28-34	20-24	51-92		
Aug., 22	Mean	29.27	20.21	73.85	51.38	7
	Range	22-33	20-23	55-92		
Sept., 22	Mean	30.46	20.83	69.99	53.16	9
	Range	25-33	19-24	50-92		
Oct., 22	Mean	32.20	17.46	72.76	77.41	5
	Range	25-36	14-21	36-92		
Nov., 22	Mean	32.38	10.55	60.33	-	-
	Range	29-36	8-15	33-91		
Dec., 22	Mean	34.07	8.0	59.21	10.40	1
	Range	20-36	3-13	33-91		
Jan., 23	Mean	35.63	5.94	58.12	-	-

	Range	26-37	2-9	24-87		
Feb., 23	Mean	35.17	9.67	66.88	-	-
	Range	29-36	6-14	47-84		
March, 23	Mean	31.01	11.91	73.50	28.88	6
	Range	22-36	10-15	36-96		

SERICULTURE KRISHI MELA CUM EXHIBITION HELD AT RSRS, IMPHAL ON 31.01.2023

Smt. Bidyarani Ayekpam, MCS, Director, DOS, Govt. of Manipur, Chief Guest and Dr. K.M. VijayaKumari, Director, CMER&TI, CSB, Lahdoigarh, Jorhat, president of the function addressing the farmers during the function.

Release of booklets by the dignitaries during the function Prize Distribution to **"Best farmers of the year"**

Gathering during Sericulture Krishimela function

"**Sericulture KrishiMela cum Exhibition"** was organized by Regional Sericultural Research Station, CSB, Mantripukhri, Imphal on 31st January 2023. At the outset of the event, a welcome speech was given by Dr. L. Somen Singh, Scientist-D to show gratitude towards the dignitaries, invitees, farmers and all the participants for making an effort to attend the event. Dr. Y. Debaraj, Scientist - D & Head, RSRS, Imphal delivered the key note address and explained that Sericulture KrishiMela cum exhibition is organised regularly every year to bring together the farmers and popularize the latest developments in sericulture (Mulberry & Vanya) technologies and to explore the problems faced by farmers in practising sericulture and acknowledge them for their contributions.

The programme was graced by Smt. Bidyarani Ayekpam, MCS, Director of Sericulture, Govt. of Manipur as Chief Guest, Shri Th. Surjaboro Singh, Chairman, Manipur State Sericulture Co-operative Federation, Ltd. (SERIFED) as Guest of Honour and Dr. K.M. VijayaKumari, Director, Central Muga Eri Research and Training Institute, CSB, Lahdoigarh, Jorhat as president. All the dignitaries congratulated and appreciated the active participation of farmers and advised the farmers to take up sericulture with sincerity to achieve good production for income generation and sustainable livelihood. They highlighted that the climatic conditions of Manipur is very much favourable for rearing all the four types of silkworms from which farmers can double or triple their income by taking up sericulture activities which are deemed more profitable than other agricultural crops. They appealed the farmers to approach the expert scientists of the station if any technical assistance is required during rearing and grainage operations.

An exhibition with 15 stalls showcasing different technologies, life cycles of silkworms, yarn samples, fabrics, cocoons, wild silk moths, reeling machines, different products, live demonstration of reeling activities was also set up which evoked much interest among farmers and invitees. Two booklets entitled "Diseases in Oak Tasar Silkworm, *Antheraea proylei* and Package of practices for Eri silkworm rearing" were released. Memento, certificates and silkworm rearing appliances were presented to the best farmers in all the sectors of sericulture which were selected based on their rearing performances during the year. After the inaugural Session, the programme was followed by a technical session where the scientists of RSRS, Imphal delivered lectures on different topics of rearing grainage, diseases and host plant maintenance and interacted with the farmers. The programme was actively participated by more than 200 participants including rearers, SHG, NGO, Entrepreneurs and Officials from Central and State sericulture Departments. The event was concluded with a vote of thanks proposed by Dr. S. Subharani Devi, Scientist-D.

WORKSHOP ON OAK TASAR CULTURE HELD AT DEHRADUN ON 10.03.2023

A one day workshop on "Oak Tasar Culture" has been conducted on 10th March 2023 at Hotel Viceroy Inn, Dehradun, Uttarakhand in coordination with DOS, Uttarakhand emphasizing the growing need for taking up focused programs for developing a roadmap for research and development in area of improving the oak tasar silk production in the country.

In the Inaugural function, Shri Ganesh Joshi, Hon'ble Minister of Agriculture and Farmers welfare, Govt. of Uttarakhand graced the occasion as the chief guest. In his address he emphasized the role of the women and their contributions in the formation of Uttarakhand state and advised them to come forward to make Uttarakhand as one of the leading producer of oak tasar silk in the country by achieving 10 MT oak tasar silk production. He advised the farmers to have a vision to achieve success and dedicate themselves in their work and also approach the government if any assistance is required. Shri Anand Kumar Yadav, Director, Directorate of Sericulture, Govt. of Uttarakhand and Dr. K. Sathynarayana, Director, CTR&TI, Ranchi graced the occasion as Guest of Honour. They also appealed the famers to promote Uttarakhand as the leading oak tasar silk producing state in the country. Dr.Sathynarayana advised the farmers to adopt the technologies of oak tasar followed by NE states and improved technologies of tropical tasar to promote oak tasar in NW states. The programme was also participated by Shri Ajeet Singh Chaudhury, Chairman UCRF, Uttarakhand. He addressed the crop loss in oak tasar culture in the final stages due to diseases. He appreciated the oak tasar dfls supplied from CSB which performed very well in the field. He also requested to organise various programmes where farmers can listen to the scientists for improvement of oak tasar silk production. The programme was also participated by other dignitaries on the dias.

Dr. K. M. VijayaKumari, Director, CMER&TI, Jorhat presided over the function. In her speech, she requested the Scientists to develop technologies for field level applications to promote oak tasar silk production. She also requested the state sericulture department to produce basic seeds to meet the farmers demand and appealed the farmers to adopt the improved technologies developed by the Institutes for increasing the oak tasar productivity. She highlighted that Manipur state alone is producing 4 MT of oak tasar raw silk and the total target for oak tasar in the country is 8 MT. So, in order to achieve the set target, she emphasized the need for NW states and other NE states apart from Manipur to chalk out strategies to meet the 8 MT target for oak tasar in the country.

The programme was followed by a technical session where experts delivered lectures on different topics on pre and post cocoon sector of oak tasar and interacted with the farmers. The programme was attended by 200 participants comprising of farmers, entrepreneurs and DOS officials from Uttarakhand, Director and Scientists from CMER&TI, Lahdiogarh, Director and Scientists from CSR&TI, Ranchi, Director (Retd.), Scientists and Officials from nested units of CSB located in and around Dehradun and scientists from RSRS, Imphal. The programme ended with a field visit arranged by the DOS, Uttarakhand for the participants.

FIELD DAY: Lainingkhul Village, Chandel District

A field day programme was organized on 08.08.2022 at Lainingkhul Village, Chandel District to create awareness amongst the farmers about the improved sericulture

technologies particularly in mulberry and eri culture and 70 farmers participated in the event along with staff of DOS and CSB.

FIELD DAY: Moirang Okshongbung, Bishnupur District


A field day programme was organized on 07.09.2022 at Phayang Village, Imphal West District to create awareness amongst the farmers about the improved sericulture technologies particularly in mulberry and eri culture and 70 farmers participated in the event along with staff of DOS and CSB.

FIELD DAY: Khurkhul (Imphal West, Manipur)

One Field Day programme was conducted at Khurkhul village (Imphal West, Manipur) on 29th November, 2022 in presence of officials from state sericulture department. In the programme, 70 sericulture farmers attended. At its onset of the programme, Dr. Y. Debaraj, Scientist-D and Head, RSRS Imphal delivered speech on various aspects of Sericulture to motivate the beneficiaries. Afterwards, Dr. Kh. Subadas Singh, Scientist-C, RSRS Imphal delivered a speech on the potential of Manipur to conduct all four types of sericulture activities in large scale based on its climatic condition and availability of all food plants. It was followed by speech from officials of DOS Manipur to improve performance of the farmers and increased silk production in the state. At the end of the programme, there was a question & answer session between farmers and scientists of RSRS Imphal to solve problems of the farmers and to improve their ideas of sericulture activities.

FIELD DAY: Yumnam Khunou, Imphal East

One Field Day programme on Sericulture was conducted at YumnamKhunou, Imphal East, Manipur on 8th February, 2023. In the programme, 70 numbers of farmers were attended. Dr. Y. Debaraj, Scientist-D and Head, RSRS Imphal delivered a comprehensive talk on overall sericulture, rearing techniques, precautionary measures during rearing, plantation and intercropping to increase farmers income in Manipur. In the programme, there was meaningful interaction between scientists and farmers on technical ideas to increase production and productivity of silk in the state.

AWARENESS PROGRAMME: Wangbal, Thoubal District

An awareness programme was organized on 11.08.2022 at Wangbal, Thoubal Districtct to create awareness amongst the farmers about the improved sericulture technologies particularly in mulberry and eri culture and 50 farmers participated along with staff of DOS and CSB attended the event.

AWARENESS PROGRAMME: Nongpok, Keithelmanbi

An awareness programme was organized on 01.10. 2022 at Nongpok, Keithelmanbi, to create awareness amongst the farmers about the different sericulture technologies particularly in mulberry and eri culture and even in post cocoon sector and 50 farmers participated in the event along with staff of DOS and CSB.

AWARENESS PROGRAMME: Kha Potsangbam, Bishnupur

One Awareness Programme on Sericulture was conducted at KhaPotsangbam, Imphal East Manipur on 16thJanuary, 2023 to demonstrate the various technologies developed by RSRS, Imphal during the ongoing spring crop grainage. 50 (fifty) farmers attended the programme.


AWARENESS PROGRAMME: Bishnupur Ward No. 6

One Awareness Programme on Sericulture was conducted at Bishnupur Ward No. 6, Manipur on 10th February, 2023to demonstrate the various technologies developed by RSRS, Imphal during the ongoing spring crop grainage. Twenty officials of DOS and CSB participated in the programme. 50 (fifty) farmers attended the programme.

TECHNOLOGY DEMONSTRATION: TAKAIMA (SENAPATI, MANIPUR)

A technology demonstration programme was organized on 22.11.2022 at Takaima**,** SenapatiDistirict, Manipurto demonstrate the various technologies developed by RSRS, Imphal. Twenty officials of DOS and CSB participated in the programme


TECHNOLOGY DEMONSTRATION: Andro, Imphal

A technology demonstration programme was organized on 23.11.2022 at Andro**,** Imphal EastDistirict, Manipur to demonstrate the various technologies developed by RSRS, Imphal. Twenty officials of DOS and CSB participated in the programme

TECHNOLOGY DEMONSTRATION: Sinam Khunou (Imphal East, Manipur)


A technology demonstration programme was organized on 08.02.2023 atAndro**,** Imphal EastDistirict, Manipur to demonstrate the various technologies developed by RSRS, Imphal. Twenty officials of DOS and CSB participated in the programme.

TECHNOLOGY DEMONSTRATION: Kwasiphai Bishnupur, Manipur

One Technology Demonstration programmes was conducted at Kwasiphai (Bishnupur, Manipur) on 10th February 2023. In the programme, around 20 sericulture farmers were attended of Mulberry, Eri and Mugarearers. During the programme, Dr. Subadas Singh briefed about disinfection procedure in the silkworm rearing field as well as in the rearing room. He demonstrated how to prepare slaked lime and bleaching powder to mix it and demonstrated the disinfection of field.

REGIONAL SERICULTURE RESEARCH STATION (RSRS), BOKO, ASSAM

Highlights of activities/achievements for each unit should be given separately.

- Sexual multiplication of S3 & S6 morphotypes of Som, their maintenance and supply to stakeholders as and when needed.
- A total of 10000 Som seedling against the target of 20000 seedlings were raised.
- Under extension and technology awareness programme 1007 farmers were covered through Krishimela, Awareness Programmes, Field Days, and Technology Demonstration Programme.
- Under training programme, 3 batches of farmer's skill Training, 5 batches of Technology Orientation Programme and 2 batches of Post Cocoon Training Programme were conducted and 250 framers/students were trained.
- Under commercial Muga crop rearing 750 g DFLs were reared against target of 2500 g DFLs to produce 7700 Nos. of commercial cocoons.
- Under Seed crop rearing 150 g DFLs were reared against target of 700 g DFLs to produce 9100 Nos. of commercial cocoons.

- The centre generated a total revenue of Rs1,41,794/-

Capacity Building and Training Institute-wise for financial year of 2022-2023

#	Name of the Trng. Programme	Target for the Year		Progress till end of the year		
		Physical	Financial	Physical	Financial	No of farmers/ Students trained
1	Exposure visit for Technology Awareness	-	-	-	-	
2	Farmers' Skill Training	3	3.375	3	3.375	75
3	Technology Orientation Programme (Officials from DoS& CSB)	2	1.90	5	4.75	125
4	Training under Post cocoon sector	2	1.80	2	1.80	50
5	Training under Sericulture Resource Centre	-	-	-	-	
6	Training under STEP by Institute	-	-	-	-	
	Sub Total	**7**	**7.075**	**10**	**9.925**	**250**
7	Training funded under - NON CBT	-	-	-	-	
8	Training funded under - NON CSB	-	-	-	-	
	Sub Total	0	0	0	0	
	Grand Total	**7**	**7.075**	**10**	**9.925**	**250**

Meteorological Data:

Year	Month	Temperature (°C)		Relative Humidity (%)		Nos. of rainy Days	Rainfall (mm)
		Max.	Min.	Max.	Min.		
2022	April	34	24	98	48	8	124
	May	36	26	98	45	12	292
	June	34	24	100	65	22	500
	July	37	26	97	55	16	172
	August	37	26	96	55	13	154
	September	35	29	98	49	13	82
	October	35	23	98	53	12	160
	November	31	27	96	48	0	0.00
	December	28	16	91	51	0	0.00
2023	January	28	18	89	45	0	0.00
	February	30	20	92	41	0	0.00
	March	35	20	94	55	4	62

Plan for land use and Resource Conservation:

Particulars	Target	Achievement
Raising of quality Som/Soalu planting material (Nos.)	20000	10000
Supply of Som/Soalu planting materials (Nos.)	20000	210
Supply of Kesseru Seeds	Nil	105kg
Muga Dfls rearing (Nos.)		
Commercial	2500	750
Seed	700	150
Muga Cocoons production Nos.		
Commercial	1500000	7700
Seed	28000	9100
Muga Dfls production (Nos.) Rs. 8.00/- Per g	7000	1600
Muga Dfls supply (g.)	7000	-
Vermicompost Production (kg)	20000	-

Extension Communication Programme:

Particulars	Target	Achievement
Krishi Mela	1	1 (300)
Field Day	4	4 (307)
Technology Awareness programme	4	4(255)
Technology Demonstration	4	4 (145)
Group Discussion	-	-
Workshop	-	-
Training	175	250

Glimpses of Vanya Resham Krishi Mela, 2023

Glimpses of Field Day, 2022-23

Glimpses of Awareness Programme, 2022-23

Glimpses of Farmer's Skill Training

Glimpses of Technology Orientation Programme


मूगा उत्पादन पर प्रौद्योगिकी अभिविन्यास कार्यक्रम
TECHNOLOGY ORIENTATION
PROGRAMME ON MUGA CULTURE
REGIONAL SERICULTURE RESEARCH STATION
CENTRAL SILK BOARD

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

Highlights of activities/achievements

The Eri Research Extension Centre, Fatehpur (U.P.) situated at Fatehpur District of U.P. was started in May, 2006 in rented building at Auraiya (U.P.) under CMER&TI, Lahadoigarh (Assam) with 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 is working there till December, 2009. There after shifted to Fatehpur (U.P.) in January, 2010 in compliance to the decision of Competent Authority by establishing Office in Private (rented building) building with objective to cater the need of Technological support and monitoring to caster grower's to Ericulture through ADS, Allipur, Fatehpur (U.P.). As per mandate and target allotted by the main Institute CMER&TI, Lahdoigarh (Assam) the following Technical activities have been performed by the Centre during the Year (2022-23) under report in Association with District DOS, U.P. for the cause of 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 Rearing an grainage, under Transfer of Technology etc.

- EREC, Fatehpur (U.P) done commendable job in U.P., Bihar and Gujarat in this year.
- EREC, Fatehpur (U.P.) received best Display Award from Gujarat regarding Live Display of Ericulture in Mega Exhibition at Mehasana, Gujarat (08.07.2022 To 10.07.2022)
- Dr. Mahesh, CMER&TI, Lahadoigarh (Assam), Shri Suraj Pal and Shri Ramjiwan demonstrated New Eri Chauwki Rearing Technology to Castor Growing Farmers of Gujarat on 31.10.2022 To 28.11.2022. The New Technology Developed by CMER&TI, Lahadoigarh (Assam) and record production recorded (200 Eri DFLs to 200Kg. Eri cocoons.

- EREC, Fatehpur (U.P.) Organized 02 Technology Awareness Meet Programme and 02 Technology Demonstration Programme organized Dist. Patan and Sabarkantha of Gujarat (12.07.2022 & 09.11.2022)
- CMER&TI and EREC, Fatehpur (U.P.) imparted Hand's on Training on Eri Silkworm Rearing to Castor growing farmers in Gujarat (30 Days. 30.10.2022 To 28.11.2022)
- EREC, Fatehpur (U.P.) imparted quality training to Eri Farmers of Banka, Bihar (100 Farmers).
- EREC, Fatehpur (U.P.) imparted quality training to Eri Farmers of U.P. (67 Farmers).
- EREC, Fatehpur (U.P.) received 1st prize from the Director, CMER&TI, Lahadoigarh (Assam) and न०रा०क०स०, फतेहपुर (उ०प्र०) for best performance of Official Language during the 2021-22.
- EREC, Fatehpur (U.P.) earned Rs. 6000.00 revenue up to 20.03.2023 by selling of Vermin Compost.

EXTENSION ACTIVITIES

Extension Communication Programme

Particulars	Physical Target (Beneficiaries Target)	Achievement (No. of Beneficiaries covered)
Technology Awareness programme	5 (250)	5 (335)
Technology Demonstration	5 (100)	5 (335)
Farmers Skill Training	3 (75)	3 (75)
Technology Orientation Programme	2 (50)	2 (50)

Meteorological Data:

Month	Temperature °C (range)		Relative Humidity (%) range	
	Mani.	Maxi.	Mini.	Maxi.
April, 2022	21-25	41-46	30-35	41-47
May, 2022	23-31	40-47	30-35	41-48
June, 2022	25-32	33-47	29-60	45-86
July, 2022	26-29	28-37	53-63	80-89
August, 2022	24-27	29-34	59-63	85-96
September, 2022	25-26	30-34	59-62	85-88
October, 2022	17-26	30-34	58-61	85-88
November, 2022	11-19	29-33	28-34	82-87
December, 2022	08-16	24-31	20-33	67-85
January, 2023	04-07	19-25	38-47	82-93
February, 2023	8.6-17	20-32	21-85	76-91
March, 2023	15-18	30-33	32-45	64-83

Photographs of activities

Technology Awareness Meet Programme in Gujarat

Technology Awareness Meet Programme in Gujarat

Awareness Programme at EREC, Fatehpur

Awareness Programme at EREC, Fatehpur

Castor Plantation at farmers filed in Fatehpur, U.P.

Eri Rearing at farmers level in Fatehpur, U.P.

Eri Cocoon Production at farmers level in Fatehpur, U.P.

Farmer Skill Training Programme conducted by EREC, Fatehpur

Farmer Skill Training Programme conducted by EREC, Fatehpur

Farmer Skill Training Programme conducted by EREC, Fatehpur

Hands on Training on Eri Silkworm Rearing to Castor Growing Farmers of Vill. Badresar, of Sabarkantha District of Gujarat.

Chawki Rearing demosntration in Gujarat

Farmers Meeting in Vill. Badresar, of Sabarkantha District of Gujarat.

Mega Exhibition in Mehasana, Gujarat

Mega Exhibition in Mehasana, Gujarat

Receiving best stall prize in Mega Exhibition at Mehasana, Gujarat

RESEARCH EXTENTION CENTRE, COOCHBEHAR, WEST BENGAL

Highlights of activities/achievements

- As per Action plan 2022-23, this office was entrusted with only three set of ECP, the two set of programmes has already been cpmpleted within August, 2023.
- Independence Day and Swachhata Hi Seva was celebrated at this unit w.e.f 2nd October to 31st October 2023 to make garbage free India.
- Observed Vigilance Awareness Week by taking oath on 30/10/23.
- Hindi Diwas/ Pakhwada was also celebrated at this unit on 1 september 2023 onwards.
- Muga and Eri garden were visited during rearing at Kalimpong, Pedong, Soreng, Matigara (Siliguri), Khagrabari, Kumargram and Chat Singimai (Patiakhawa) etc for supply of technology to the farmers.

#	Schemes	Target for the year		Achievement		Remarks
1		Physical	Financial	Physical	Financial	
	Technology Awareness Programme	05	0.5	05	0.5	100%
2	Technology Demostration Programme	05	0.05	05	0.05	100%


Technology Awareness programme conducted at Chat Singimari

Technology Awareness programme conducted at FRSS, Kalimpong.

IMPORTANT EVENTS ORGANIZED BY CMER&TI, LAHDOIGARH

Glimpses of Vanya Reshom Krishimela organized at Sadiya on 10.01.2023





Glimpses of Workshop organized at CMER&TI, Lahdoigarh on 07.03.2023







63rd – 66th) Research Council meeting of CMERTI Lahdoigarh was held under the Chairmanship of Dr. K M Vijyakumari, Director

The 40th Research Advisory Committee meeting of CMERTI, Lahdoigarh was held on 28th – 29th June 2022 under the Chairmanship of Prof. L.K. Hazarika, Retd. Professor and, Assam Women University, Jorhat and Dr. Bidyut Kumar Sarmah, Director, DBT-North East. The 41st Research Advisory Committee meeting of CMERTI, Lahdoigarh was held on 24th January 2023 under the Chairmanship of Prof. Bidyut C Deka, Vice-Chancellor, Assam Agricultural University.

संस्थान में राजभाषा हिंदी की ८०वी तिमाही बैठक का आयोजन किया गया. जिसमे अध्यक्षा महोदया ने संस्थान में हिंदी में कार्य के प्रगति की समीक्षा किया. संस्थान में राजभाषा हिंदी कार्यशाला का आयोजन किया गया. जिसमे श्री सूरज पाल, वैज्ञानिक-डी ने हिंदी में सुगमता पूर्वक कैसे कार्य करें के बारे में विस्तृत व्याख्यान दिया.

One day Workshop on "OAK TASAR CULTURE" held on 10th March at Dehradun, Uttarakhand. Dr KM Vijaya Kumari, Director, CMER&TI presided over the function. The event was attended by scientists, experts, Oak Tasar farmers, NGOs & entrepreneurs. Technical presentations were followed by threadbare discussions on promotion of Oak Tasar in Uttarakhand & rest of the Country.

Women's day was celebrated at CMERTI Lahdoigarh on 08.03.2023.

Technological Workshop on "Pests and Disease Management of Muga and Eri Silkworms" was conducted at the Institute premises of CMERTI Lahdoigarh on 07.03.2023.

Plantation drive at CMERTI

Swacchata Pakhwada, 2023 w.e.f 01.03.2023 to 15.03.2023 at CMERTI Lahdoigarh.

A combined Review meeting on Sericulture Projects for North Eastern Region was held at Guwahati on 25.02.2023. The progress of all the projects being implemented were reviewed in 2 different Sessions which was presided by Dr. K.M. Vijaya Kumari, Director CMER&TI (Additional charge of MESSO) in the first session and Shri. R R Okhandiar, Member Secretary of Central Silk Board in techical session along with respective DoS officials from the concerned states, officers from CSB units in NE states were also present in the meeting

Workshop on Muga and Eri Seed production and Supply: Challenges and opportunities. at Guwahati, conducted by Messo Central Silk Board, Ministry of Textiles, Government of India (03.02.2023)

Vanya Reshom Krishimela was organised by RSRS, Boko, under CMERTI Lahdoigarh which was graced by Assam Gaurav awardee Dr. Jogesh Deuri, OSD-DoS BTR as chief guest and Dr. Tapan Dutta, Principal JN College Boko, Sri. B Choudhary and Sri. Jiban K Deka, Deputy Director, DoS Assam as guest of honour presided by Dr. K.M. Vijaya Kumari, Director, CMER&TI Lahdoigarh and Sri. B N Choudhury, PMC-NER CSB along with scientists from CMERTI main institute and MESSO units.

Sericulture Krishi Mela cum Exhibition was successfully organised by RSRS Imphal on 31.01.2023

दिनांक 28.01.2023 को CTRTI, राँची द्वारा आयोजित समग्र रेशम उत्पादन – चुनौतियाँ एवं भावी रणनीति विषय पर राष्ट्रीय राजभाषा तकनीकी सेमिनार मेंसंस्थान के वैज्ञानिकों ने सक्रिय रूप से भाग लेकर मौखिक और पोस्टर प्रस्तुति दिया जिसमें 3 वैज्ञानिकों को मौखिक और पोस्टर प्रस्तुति में पुरस्कार प्राप्त हुआ है।

Few glimpses of 74th Republic Day celebrations at the main Institute and Quarters premises.

STEP Training Program was conducted for all the technical personnel of this Institute and its nested units from 23rd -25th November by the Training Division.

Dr. C. M. Kishor Kumar, Director, CSRTI Behrampore visited CMER&TI, Lahdoigarh




Padma Shri Prof. S. Ayyappan, Chairman Research Coordination Committee, Central Silk Board visited CMER&TI, Jorhat on 17.11.2022


CMER&TI conducted test verification of the new Muga cocoon cooking formulation among the reelers of Dhemaji District, Assam in coordination with ADS, Dhemaji, DOS Assam.

CMERTI Lahdoigarh is observing Vigilance awareness week, a quiz and poster competition was successfully organized at Sunrise School, Meleng 11.11.2022, Jorhat.

National Unity Day was celebrated by CMERTI Lahdoigarh to commemorate the 147th birth anniversary of India's first home minister Sardar Vallabhbhai Patel on 31.10.2022

Team of scientists from CMERTI Jorhat along with the scientists of Defence Research Laboratory, Tezpur; officers of Agriculture department, Tawang; officers of Horticulture department, Tawang and KVK scientists participated in 3rd Kissan-Jawan-Vigyan mela held at Tawang (Arunachal Pradesh) organized by Defence Research Laboratory (DRL), Tezpur

Scientists of CMER&TI participated in the workshop conducted by DoS, Assam at Guwahati (Assam) under OPIU-Sericulture (APART).

CMERTI Lahdoigarh paid floral tribute to Late Shri Syama Prasad Mookerjee and took a 'Silk Day' pledge followed by falicitation to the progressive Muga & Eri stakeholders.

Participated in Bihar state level workshop on Silk Samagra-2" held at Patna on 07.09.2022. Technological interventions by CMERTI for augmentation of Ericulture and support for Eri components in Silk Samagra-2 scheme was presented.

CMER&TI celebrated its 23 years of glorious establishment on 01.09.2022.

“Har Ghar Tiranga” ahead of Independence day celebrations, The Tiranga National flags were hoisted on all the Institute building and farms of CMERTI Lahdoigarh

CMERTI Lahdoigarh took part in 11th India International Silk Fair organized by Indian Silk Export Promotion Council (ISEPC) from 28th - 30th July at New Delhi.

Open Top Chambers (Climate Change facility) was installed and inaugurated by Smt. Kajori Rajkhowa, Director, Sericulture, DoS, Govt. of Assam, and Dr. Bidyut Kumar Sarmah, Director, DBT-North East on 28th June 2022.

Micro-climatic Chamber (Climate Change facility) was inaugurated by Prof. L K Hazarika, Retd. Professor & Academic Registrar, Assam Women University Jorhat and Dr. Bidyut Kumar Sarmah, Director, DBT-North East on 28th June 2022. On this occasion, Smt. Kajori Rajkhowa, Director or Sericulture, DoS, Govt. of Assam, Dr. B K Singh, Retd Director of CMERTI and other dignitaries from State Sericulture Department and Central Silk Board were also present to grace the occasion.

On the occasion of International Yoga Day, a yoga session was organised at the Institute premises wherein all the happy souls of CMERTI actively participated in the event.

A State level workshop of Assam on Implementation of Central Sector Scheme "Silk Samagra-2" for development of Silk Industry in Assam was organized by Directorate of Sericulture, Assam in Association with RO, CSB, MoT, Govt. Of India on 20th June 2022 at Assam Administrative Staff College, Khanapara, Guwahati (Assam).

Dr K M Vijaykumari Director CMERTI Lahdoigarh along with Scientists from Central Silk Board and State Sericulture department officials of BTC visited Bengtol farm on 11.06.2022 which is presently having 2 lakhs of Kesseru nursery followed by another private nursery at Chirang district under Bodoland eri mission project.

Dr. K M Vijaykumari Director CMERTI Lahdoigarh inaugurated an Incubation Centre under Tapioca based Ericulture project, NERTPS 2020-21 at Bhaoragwaja, Kokrajhar, BTR on 11.06.2022

Dr. K M Vijaykumari, Director, CMERTI Lahdoigarh attended a State Level Workshop on implementation of Silk Samagra -2 (2021-2026) conducted by Dept. Of Sericulture, BTC and Sponsored by Central Silk Board at Kokrajhar on 10.06.2022.

CMER&TI celebrated World Environment Day on 5.6.2022 with theme Only One Earth. On the day, under the leadership of Director, Dr KM Vijaya Kumari.

Adopted Seed Rearers (ASRs) of Muga from Lakhimpur and Sibasagar visited at CMER&TI along with officials of Sericulture Training Institute, Titabor on 3rd June 2022.

CMER&TI observed Anti-Terrorism Day on 21.5.2022 taking pledge to spread awareness against terrorism and not to indulge in any violence. The observation is to promote peace and harmony in the country.

Director, Dr. K.M.Vijaya Kumari & Dr. Reeta Luikham, Senior scientist attended in the august programme, North East Research Conclave 2022 at IIT Guwahati on 20.05.2022 which aims to create an environment that promotes and encourages research in Science & Technology.

Honourable Minister of Science and Technology, GoI, Dr. Jitendra Singh ji visited at CMER&TI exhibition stall during inauguration of I-CONNECT program held at CSIR NEIST, Jorhat on 12.5.2022.

CMER&TI observed Earth Day on 22nd April 2022 with mass plantation of Dighloti (*Litsea salicifolia*) plants in the institute campus with banners and posters for public awareness under the leadership of Dr. K.M. Vijaya Kumari, Director, CMER&TI.

TRANSFER OF TECHNOLOGY PROGRAMS (ToTs):

1. On Station Trials (for demonstration of technology at CSB institutes, RSRSs, and DoS units etc.)

Under the On Station Trials (OST) of 9 technologies were carried out at 27 different locations against a target of 40 locations.

#	Name of the Technology	Target	Achievement	Anticipated Impact
1	Validation of IPM technology for control of uzi fly in oak tasar culture	RSRS-2 & DOS-3	RSRS-2, & DOS-3	Percentage of uzi infestation recorded was 6-9 % with IPM as against 16-20 % in control.
2	Validation of use of Biopesticides for control of insect pest infesting *Q. serrata*.	RSRS-2 & DOS-3	RSRS-2, & DOS-3	Recorded 70-75% reduction of pest infestation on 14th day after application of Bioneem.
3	Multi-location trials of muga breeds CMR-1 CMR-2	CMERTI – 1, RSRS-3, DOS-2	CMERTI – 1, RSRS-3, DOS-2	Multi-location trials of muga breeds CMR-1 and CMR-2 was conducted in May-June at 6 locations. The performance was on par with control. And another round of multi location trial is going on at six locations.
4	Multi-location trials of Eri breeds/ cross breeds	CMERTI–1, & RSRS-3 & DOS-2	CMERTI–1, & RSRS-3 & DOS-2	Overall performance showed that C2 breed was found better in terms of ERR, shell weight, shell ratio in comparison with cross hybrids.
5	Development of seed preservation technology for Muga silkworm	CMERTI–2	CMERTI–1	85.18% moths were emergence recorded after 42 days cold preservation. 6.83% moths were found healthy and 78.35% were found crippled.
6	Trial of formulated volatiles application for enhancing egg laying capacity of Muga silk moth during commercial crop.	RSRS- 2 & CMERTI–1	CMERTI–1 RSRS-1	Blends are presently being test verified at main Station. 13% improvement was observed in Jarua seed crop.

#	Name of the Technology	Target	Achievement	Anticipated Impact
7	Trial of formulated volatiles application for enhancing egg laying capacity of Eri silk moth during commercial crop.	RSRS- 1 & CMERTI–1 & DOS-1	CMERTI–1	Blends are presently being test verified at main Station with Borduar, Kokrajhar and C2 seeds. 25-30% improvement was observed in all 3 ecoraces over control in favorable season.
8	Validation of muga silkworm egg treatment for uniform hatching and higher survivability of young larvae.	CMERTI–3 RSRS-1	CMERTI–1	Trial could not be completed as DFLs were not supplied by MESSO on time.
9	Rearing management of Muga silkworm in cooler region during summer	RSRS- 5 & CMERTI–1	-	Trial could not be completed as DFLs were not supplied by MESSO.

2. On Farms Trials (for demonstration of technology at farmers' level)

OFT of 12 technologies were carried out at different locations covering 448 beneficiaries against a target of 680 beneficiaries.

#	Name of the Technology	Beneficiary Target	Achievement	Anticipated Impact
1	Popularization of Kesseru Eri host plant HF-005 and HF-008	400	243	6900 Kesseru (HF-008 & HF-005) seedlings were distributed to 69 Eri farmers. 5085 Borpat seedlings were distributed to 37 farmers. 125 kg Castor (NBR) seeds and 3010 Som seedlings were distributed to 137 farmers for block plantation in Sivasagar, Jorhat, Golaghat and Dibrugarh area.
2	Popularization of Borpat Eri host plant			
3	Popularization of other host Pants (Som, Dighloti and Castor)			

#	Name of the Technology	Beneficiary Target	Achievement	Anticipated Impact
4	LED light trap for control of muga insect pests	30	30	Trials were conducted in upper Assam, lower Assam and middle Assam areas with 10 farmers each location. It decreases pest infestation 20-30% to both muga silkworm as well as its host plants. The device is recommended for field application in larger scale to control different insect pests.
5	Evaluation and popularization of Eri egg incubation device.	50	30	The trial has been conducted during summer season and found that 15-20% improvement in hatching in new eri egg incubation device over the control.
6	Formulation for controlling bacterial flacherie disease in Muga silkworm.	50	40	Formulation is supplied to the farmers to control the Flacherie disease during the rearing in month of May. Rearing failed due to constant rains.
7	Validation of use of PET bottles for uzi trap in muga silkworm rearing	30	30	PET bottles were installed for 7 days at 30 farmers' field at different locations in Upper Assam, Lower Assam and Middle Assam. Only wasps, butterflies and other small unidentified beetles were trapped in the PET bottles
8	Integrated Practice of ITK and Modern Technology for Muga Silkworm Seed production.	40	30	OFT conducted at 19 farmers field in Charideo, Sivsagar, Lakhimpur and Dibrugarh district

#	Name of the Technology	Beneficiary Target	Achievement	Anticipated Impact
				during September, October and December 2022 has shown to increase fecundity significantly by 17.4% over the normal practice
9	Integrated Practice of ITK and Modern Technology for Higher Muga cocoon yield	30	25	Dfls were supplied to 15 farmers of Charideo, Sivsagar and Lakhimpur and Dibrugarh district for Late Bhadia crop (Sep-Oct), Kaotia crop (Oct-Nov) and Jarua crop (Dec-Jan) during 2022 -23. Cocoon yield during Late Bhadia crop (Sep-Oct) and Kaotia crop (Oct-Nov) increased significantly by 15.8% over the existing practice. Rearing of Jarua crop conducted at 5 farmers field in Sivsagar district is under progress
10	Establishment and Popularization of new breed C27 among farmers	10	10	Rearing performance of C27 breed showed 21-25 cocoons per dfl as against 15-20 cocoons per dfl in *A. proylei* (control) during 2nd crop.
11	Validation of use of PET bottles for uzi trap in oak tasar silkworm rearing	30	30	Percentage of uzi infestation recorded was 10–12% with PET bottle uzi trap as against 16-20% in control.
12	Validation of use of Sodium hypo-chlorite for seed treatment against tiger band disease of oak tasar silkworm	10	10	Rearing performance of 0.2% Sodium hypochlorite treated lot recorded 20-26 cocoons per dfl as against 15-20 cocoons per dfl in control during 2nd crop.

राजभाषा हिंदी गतिविधियों की मुख्य विशेषताएं

- संस्थान में राजभाषा कार्यान्वयन समिति की तीन बैठकों एवं तीन एकदिवसीय हिंदी कार्यशाला का आयोजन किया गया। राजभाषा कार्यान्वयन समिति की 77-80 वीं बैठक का आयोजन किया गया जिसका संचालन संस्थान की निदेशक महोदया डॉ के.एम.विजया कुमारी ने किया।
- नगर राजभाषा कार्यान्वयन समिति, जोरहाट द्वरा वर्ष 2022-23 के दौरान राजभाषा हिन्दी के उत्कृष्ट कार्यान्वयन हेतु केन्द्रीय मूगा एरी अनुसंधान व प्रशिक्षण संस्थान को पुरस्कार का नाम से पुस्कृत किया गया तथा हिन्दी मे निष्ठापूर्वक प्रयासों को भी सराहा गया।
- राजभाषा हिंदी के प्रोत्साहन के लिए संस्थान के सभी विभागों और अनुभागों के बीच उत्कृष्ट कार्य करने के लिए "चल शील्ड" से सम्मानित किया जाना शुरु किया गया।
- एकदिवसीय हिंदी कार्यशाला का भी आयोजन दिनांक 07.07.2022 को नगर राजभाषा कार्यन्वयन समिति, जोरहाट के अधक्ष्य श्री अजय कुमार जी ने कक्षादन किया और नोटिंग ड्राफिंग तथा त्रूतियों के बारे में विस्तृत जानकारी दिया। उन्होंने संस्थान में राजभाषा हिंदी के प्रगति पर संस्थान को बधाई दिया।
- संस्थान में एकदिवसीय हिंदी कार्यशाला का भी आयोजन दिनांक 27.03.2023 को किया गया। जिसमें श्री सूरज पाल, वैज्ञानिक – डी, एरी अनुसंधान विस्तार केन्द्र, फतेहपुर ने राजभाषा के उपर कक्षादान किया और राष्ट्रभाषा हिंदी का कार्यालयों में प्रयोग के बारे में विस्तृत जानकारी दिया। जिसमें 11 अधिकारी एवं 14 कर्मचारियों ने भाग लिया।
- दिनांक 14-09.2022 और 26-12.2022 को संस्थान में एकदिवसीय हिंदी कार्यशाला का भी आयोजन भी किया गया। जिसमें श्रीमती मंगलेम देवी, वरिष्ठ हिंदी अनुवादक, आरएसआरएस, इम्फाल ने हिंदी नोटिंग और ड्राफिंग के उपर कक्षादान किया और नोटिंग ड्राफिंग तथा सूक्ष्म त्रूतियों के बारे में विस्तृत जीनकारी दिया।
- केन्द्रीय तसर अनुसंधान एवं प्रशिक्षण संस्थान, राँची में दिनांक 28 जनवरी, 2023 को आयोजित "समग्र रेशम उत्पादनः चुनौतियों एवं भावी रणनीति" विषय पर संस्थान के 06 वैज्ञानिकों ने भाग लिया और शोध पत्रों को प्रस्तुती हिंदी में किया तथा लीड शोध पत्र को भी प्रस्तुत किया गया। इस तकनीकि सेमिनार में तीन वैज्ञानिकों ने अलग – अलग थीम में प्रथम पुरस्कार प्राप्त किया।

- दिनांक 1 सितम्बर से 14 सितम्बर, 2022 तक हिंदी पखवाड़ा और हिंदी दिवस का आयोजन किया गया जिसमें संस्थान के सभी आधिकारी, कर्मचारी और दक्षता कुशल कर्मियों के लिए विभिन्न प्रतियोंगितायों का आयोजन किया गया।


दैनिक पूर्वोदय

निस्ट में नराकास की बैठक, केंद्रीय मूगा एरी संस्थान को मिला पहला पुरस्कार


भारत सरकार
Government of India
गृह मंत्रालय
Ministry of Home Affairs
नगर राजभाषा कार्यान्वयन समिति (नराकास), जोरहाट:असम
TOWN OFFICIAL LANGUAGE IMPLEMENTATION COMMITTEE (TOLIC), JORHAT: ASSAM
अध्यक्ष का कार्यालय CHAIRMAN OFFICE
सीएसआईआर-उत्तर-पूर्व विज्ञान तथा प्रौद्योगिकी संस्थान, जोरहाट :असम
CSIR-NORTH EAST INSTITUTE OF SCIENCE AND TECHNOLOGY(NEIST), JORHAT-785006 : ASSAM
(भारत सरकार, विज्ञान एवं प्रौद्योगिकी मंत्रालय अंतर्गत एक राष्ट्रीय अनुसंधान संस्थान)
प्रशस्ति पत्र
जोरहाट शहर में अवस्थित केंद्र सरकार के कार्यालयों के बीच वर्ष 2022-23 के दौरान राजभाषा हिंदी कार्यान्वयन के बेहतर प्रदर्शन एवं उत्कृष्ट कार्य संपादन के लिए केंद्रीय मुगा एवं एरी अनुसंधान एवं प्रशिक्षण संस्थान, केंद्रीय रेशम बोर्ड, जोरहाट को नराकास की 40वीं बैठक में 30 अगस्त 2023 को प्रथम पुरस्कार के रूप में शिल्ड के साथ यह प्रशस्ति पत्र प्रदान किया जाता है।
(अजय कुमार)
सचिव, नगर राजभाषा कार्यान्वयन समिति, जोरहाट
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- A Kumar, AA Shabnam, SA Khan (2022). Accounting on silk for reducing microplastic pollution from textile sector: a viewpoint. Environmental Science and Pollution Research, https://doi.org/10.1007/s11356-022-23170 (IF =5.1, NAAS Score = 11.1)
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1. Dharmendra Kumar Jigyasu, Amit Kumar, Aftab A. Shabnam, KM Vijayakumari, (2022). Kesseru Nursery Raising Techniques and Management. Central Muga Eri Research & Training Institute, publication, Booklet No. 03. pp-08.

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- Wahengbam Sapana Devi, Amit Kumar, Aftab A. Shabnam, Padmini Barua, Priyanka Sahu, Om Prakash Patidar, KM Vijaya Kumari, Dharmendra KumarJigyasu. (2022). Fortification of muga host plant leaves with sea weed extract: Qualitative and quantitative improvement in cocoon production. pp-125.In National Symposium on Vanya Sericulture: An Opportunity Galore, 28th& 29th Oct., 2022 at CTR&TI, Ranchi, Jharkhand. ISBN 978-81-958770-0-3.
- Y. Debaraj, S. Subharani, L. Somen Singh and K.M. VijayaKumari (2002). Studies on rearing performance of three eco-races and one improved breed of eri silkworm, Samia ricini (Donovan) (Lepidoptera: Saturniidae in Manipur. National Seminar on "Climate Smart Sericulture–2022: Approaches for Sustainable Sericulture held at Bangalore 6-7th October, 2022.

Awards/ recognitions:

1) Dr. Mahesh DS received 2nd prize for best oral presentation under the theme "Recent advances in Mulberry & Non-mulberry silkworm and it's host plants improvement & Management" in National Symposium on Vanya Sericulture: An Opportunity Galore held on 28th & 29th October conducted by CTR&TI, Ranchi,
2) Dr. Mahesh DS received 3rd prize for best oral presentation under the theme session "Recent advances in mulberry & non-mulberry silkworm and its host plants improvement

and management" of National Seminar on "Climate Smart Sericulture-2022: Approaches for Sustainable Sericulture" organized by CSB held at NIFT, Bengaluru on 6th & 7th Oct., 2022.

3) Dr. L. Somen Singh, Scientist-D received 2nd Best paper Award in the National Seminar on "Climate Smart Sericulture–2022: Approaches for Sustainable Sericulture held at Bangalore 6-7th October, 2022 for the research paper Conservation and Utilization of Oak Tasar Silkworm in Manipur.
4) Dr. Kh. Subadas Sibgh, Scientist-C received Best poster Award in National Symposium Vanya Sericulture Opportunities Galore held at Ranchi on 28-29th October, 2022 for the research paper Seasonal occurrence, biology and feeding behaviour of Eocanthecona furcellata Wolf predating Muga silkworm Antheraea assamensis Helfer in Brahmaputra valley of Assam.
5) Amit Kumar, Scientist-C received Best paper award-3rd and presented Lead Paper in National Seminar on Climate smart sericulure-2022: Approaches for sustainable sericulture organised by Central Silk Board, Ministry of Textile Govt. of India, Bengaluru during 6-7 Oct 2022.
6) Dharmendra Kumar Jigyasu, Scientist-C, Best paper award-3rd in National Seminar on Climate smart sericulure-2022: Approaches for sustainable sericulture organised by Central Silk Board, Ministry of Textile Govt. of India, Bengaluru during 6-7 Oct 2022.
7) Dharmendra Kumar Jigyasu, Scientist-C, Best paper award-1st in National Symposium Vanya Sericulture Opportunities Galore held at Ranchi on 28-29th October, 2022.
8) Aftab A Shabnam, Scientist-D, Best paper award-3rd in National Seminar on Climate smart sericulure-2022: Approaches for sustainable sericulture organised by Central Silk Board, Ministry of Textile Govt. of India, Bengaluru during 6-7 Oct 2022.

GRANTS –IN-AID FOR THE YEAR 2022-23

Head	GIA RECEIVED	EXPENDITURE INCURRED	SURRENDERED
Plan Salary			
NE-SC Salary	7,28,00000.00	7,28,00000.00	-
NE-ST Salary	2,75,53,272.00	27553272.00	-
Plan (NE Salary)	10,79,67,430.00	107967430.00	-
Plan (General)	2,61,00,000.00	2,61,00,000.00	-
Plan (NE General)			
Plan Capital			
Plan (NE Capital)	1,11,00,000.00	1,11,00,000.00	-
Total	**24,55,20,702.00**		-

EXTERNAL FUND BALANCES FOR THE YEAR 2022-23

Head	DBT Fund	DST FUND
Opening Balance as on 01.04.2021-2022	2204330.00	1062919.00
Amount Received during the year (including interest)	1102883.00	17029.00 (interest)
Expenditure during the year	702490.00	652559.00
Surrendered during the year	25158.00 (int)	i) 43897.00 (Unspent) ii) 99500.00 (interest)
Closing Balance	426846.00	283992.00

Progress at a glance for the year 2022-2023

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 laksh)	Other activities	Revenue generated (Rs. in Lakhs)
	Ongoing projects during the year	Concluded Projects during the year	Newly initiated Projects	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	08	11	02	01	03	0	09	27	12	39	448	88	1998	62	4257	3	224	01	154	2.5	38.8

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केन्द्रीय मूगा एरी अनुसंधान एवं प्रशिक्षण संस्थान
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