



वस्त्र मंत्रालय
MINISTRY OF
TEXTILES



वार्षिक प्रतिवेदन ANNUAL REPORT 2021-2022



केन्द्रीय मूगा एरी अनुसंधान व प्रशिक्षण संस्थान
CENTRAL MUGA ERI RESEARCH AND TRAINING INSTITUTE
केन्द्रीय रेशम बोर्ड Central Silk Board
वस्त्र मंत्रालय, भारत सरकार Ministry of Textiles, Govt. of India
लाहदोईगढ़, जोरहाट-785700, असम Lahdoigarh, Jorhat-785700, Assam

वार्षिक प्रतिवेदन

Annual Report 2021-22



केन्द्रीय मूगा एरी अनुसंधान व प्रशिक्षण संस्थान
केन्द्रीय रेशम बोर्ड

वस्त्र मंत्रालय, भारत सरकार
लाहदोईगढ, जोरहाट-785700, असम

Central Muga Eri Research and Training Institute
Central Silk Board

Ministry of Textiles, Govt. of India-785700
Lahdoigarh, Jorhat-785700, Assam

के.मू.ए.अ.व.प्र.सं. की वर्ष 2021–2022 की वार्षिक प्रतिवेदन
Annual Report 2021-22 of CMER&TI

प्रकाशन का वर्ष : अप्रैल, 2022

Year of publication : April, 2022

ISBN: 978-81-959292-1-4

प्रकाशक Published by:

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

केन्द्रीय रेशम बोर्ड Central Silk Board

लाहदोईगढ़ Lahdoigarh–785700

जोरहाट, असम Jorhat, Assam

दूरभाष Phone: (91) 0375–2335513 / 2335124

फैक्स Fax: (91) 0376–2335528

वेबसाइट website: www.cmerti.res.in

संकलन Compilation

Dr. Manjunath RN, Scientist-C

संपादक—मंडल Editorial Board

Dr. Aftab A Shabnam, Scientist-D

Dr. Dharmendra K. Jigyasu, Scientist-C

आवरण रचना Cover Design

डॉ. धर्मेन्द्र के. जिज्ञासु, वैज्ञानिक—सी Dr. D.K. Jigyasu, Scientist-C

तकनीकी सहायता Technical support

श्रीमती निलिमा दत्त भुयां Mrs. Nilima Dutta Bhuyan, TA

हिन्दी अनुवाद Hindi Version

डॉ. धर्मेन्द्र के. जिज्ञासु, वैज्ञानिक—सी Dr. D.K. Jigyasu, Scientist-C

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

सर्वाधिकार सुरक्षित All rights reserved

द्विभाषी (हिंदी और अंग्रेजी): 50 प्रतियां

Bilingual (Hindi & English): 50 Copies

Our Vision

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

Our Mission

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

CONTENTS

प्रस्तावना Foreword	5-8
CMER&TI at a glance	9
Mandate of the institute	9
Human resources	10
Extension network	11
Organizational set-up	11
Scientific personnel	12-16
Delegated and non-delegated units	16
Research Advisory Committee	17
Highlights of the achievements	18-23
List of R&D projects	24-27
Achievements in R&D projects	28-72
Silkworm	29-44
Host plant	45-60
Biotechnology	61-68
Sericulture extension, economics and management	69-72
Extension & training activities of main institute	73-74
Activities of nested units	75-96
Important events	97-100
Transfer of technologies	101-104
Capacity Building and Training	104
Hindi Activities	105-106
Publications	107-110
Financial target and achievements	111
Progress at a glance for the year 2021-2022	112



प्रस्तावना

संस्थान की वर्ष 2020-21 की वार्षिक रिपोर्ट का प्रकाशन करते हुए मुझे बहुत अत्यंत प्रसन्नता हो रही है। यह रिपोर्ट केन्द्रीय मूगाएरी अनुसंधान एवं प्रशिक्षण संस्थान, लहदोईगढ़, जोरहाट की गतिविधियों और उपलब्धियों का पूरे साल का सारांश है। हमारा संस्थान दो दशकों से रेशम किसानों/लाभार्थियों की सेवा करने और पूर्वोत्तर भारत में वन्या रेशम मूगा, एरी और तसर विकास के इतिहास का एक हिस्सा रहा है। जिससे कुल वन्या रेशम उत्पादन को बढ़ाने में, किसानों और अन्य लाभार्थियों की मदद करने में हमें बहुत अधिक संतुष्टि मिलती है। हमने कई तकनीकों का विकास और उनका सफलतापूर्वक व्यवसायीकरण भी किया है। मैं इस अवसर पर सभी वैज्ञानिकों और संस्थान के अन्य सहायक कर्मचारियों के सहयोग को याद करती हूँ, और उन सभी लाभार्थियों/किसानों को भी जो नई तकनीकों को अपनाते हुए मूगा, एरी और ओक तसर रेशम उत्पादन को बढ़ाने में मदद करते हैं। यद्यपि वन्या रेशम के क्षेत्र में अनुसंधान, विकास और विस्तार में एक महत्वपूर्ण प्रगति हुई है, लेकिन ज्वलंत मुद्दों को संबोधित करने के लिए अभी एक लंबा रास्ता तय करना है। बदलती जलवायु और बढ़ते प्रदूषण के कारण रेशम उत्पादन कार्य और उसके अनुसंधान में निरन्तर प्रगति करने के लिए और अधिक चुनौतीपूर्ण बना हुआ है। इन सभी को ध्यान में रखते हुए, संस्थान ने अधिक उपज देने वाले मूगा, एरी और तसर रेशम कीटों की वेराइटी को विकसित करना, उन्नत किस्मों के मेजबान/खाद्य पौधों को विकसित करना, रेशम कीट पालन पर जलवायु परिवर्तन के प्रभाव का अध्ययन करना तथा वन्या रेशम की टोंके रोगों को बेहतर प्रबंधन इत्यादि के लिए नए परियोजनाओं की शुरुआत की गयी है।



रेशम कीट प्रभाग ने अनुसंधान और विकास में एक महत्वपूर्ण प्रगति की है। बेहतर रीलेबिलिटी और कच्चे रेशम की रिकवरी के साथ मूगा कोकून में एक समान कोकून पकाने के लिए एक त्वरित और कुशल कोकून पूर्व-उपचार विधि विकसित की गई और इसका परीक्षण द्वारा सत्यापित किया जा रहा है। एरी चौकी कीट पालन तकनीक का मानकीकरण किया गया। 5000 डीएफएल ब्रशिंग क्षमता वाले कम लागत वाले एरीचौकी कीट पालन गृह का डिजाइन और निर्माण किया गया। एरीचौकी पालन प्रौद्योगिकी को अपनाने से पारंपरिक पालन की तुलना में कोकून उपज में 20% की वृद्धि की उम्मीद है। मूगा रेशम कीट सुधार कार्यक्रम के तहत, कॉम्पैक्ट कोकून के साथ फिलामेंट की लंबाई और उर्वरता में सुधार जैसी बेहतर विशेषताओं के साथ एक आशाजनक मूगा रेशम कीट लाइन को सीमित परीक्षणों के तहत शॉर्ट लिस्ट किया गया और परीक्षण सत्यापित भी किया गया।

मेजबान/खाद्य पौध प्रभाग द्वारा लगातार वन्या रेशम कीटों के खाद्य पौधों की गुणवत्ता और मात्रा को बढ़ाने के दिशा में काम किया जा रहा है। खाद्य पौध प्रभाग बार हमासी अरंडी की खेती के विकास की दिशा में काम कर रहा है और 28 अभिवृद्धि (22 बारहमासी और 6 वार्षिक) के साथ अरंडी जीन-पूल को समृद्ध किया है। इन परिग्रहणों की विशेषता बताई गई और भविष्य के संदर्भ के लिए एक "विवरणकर्ता-सह-कैटलॉग" प्रकाशित किया गया। इस वर्ष के दौरान 167 लाभार्थियों को सुपीरियर मूगा और एरी खाद्य/होस्ट पौधों के 17435 पौधों की आपूर्ति

की गई। इसने लगभग 40 एकड़ खेतों के लिए बेहतर खाद्य/होस्ट पौधों के रोपण को बढ़ाने में सहायता मिलेगी। पूरे भारत में विभिन्न केंद्रीय रेशम बोर्ड की इकाइयों को 35 किलोग्राम के से रूबीज की आपूर्ति की गई। असम के सभी जिलों के लिए दीर्घकालिक मौसम और रेशम उत्पादन के आंकड़ों के आधार पर "असम के मूगा उत्पादक जिलों केसेरी-जलवायु नियमावली" नामक पुस्तक का प्रकाशन किया गया है।

जैव प्रौद्योगिकी प्रभाग द्वारा विभिन्न परियोजनाओं पर काम किया जा रहा है जो अंततः पूर्वोत्तर भारत में वन्या रेशम को बेहतर बनाने में मदद करता है। मूगा रेशम कीट के जीनोम और ट्रांसक्रिप्टोमडेटा को वन्या सिल्क बेस में एकीकृत किया गया है।

इस वर्ष प्रशिक्षण प्रभाग ने मूगा, एरी और ओकतसर रेशम की नई तकनीकों और पद्धतियों पर किसानों, अधिकारियों, छात्रों और गैर-सरकारी संगठनों के सदस्यों के लिए प्रशिक्षण कार्यक्रमों को सफलतापूर्वक पूरा करके निर्धारित लक्ष्य को हासिल किया है। विस्तार प्रभाग ने बड़ी संख्या में किसानों को कवर करते हुए कुल 156 विस्तार संचार कार्यक्रम इस साल पूरे किए हैं। रेशम मॉडल गांव कार्यक्रम के तहत नई कीटपालन तकनीकी और प्रौद्योगिकियों का प्रदर्शन किया गया है।

केन्द्रीय मूगा एरी अनुसंधान एवं प्रशिक्षण संस्थान और इसकी नेस्टेड इकाइयों ने अपने-अपने लक्ष्यों की प्राप्ति के लिए सरहनीय कार्य कर रही हैं। आर.एस.आर.एस., इम्फाल ने ओकतसर रेशम के कीड़ों से संबंधित अनुसंधान और विस्तार गतिविधियों में सबसे आगे रहा है। आर.एस.आर.एस., बोको निचले असम के रेशम किसानों के साथ-साथ पश्चिम बंगाल के किसानों की जरूरतों और उनकी मदद करने के लिए तत्पर रहता है। आर.ई.सी.ने मूगा और एरी कोकून उत्पादन बढ़ाने में किसानों की मदद करते हुए इस वर्ष के लिए अपने लक्ष्य हासिल किए हैं।

मैं अनुसंधान सलाहकार समिति (Research Advisory Committee) के अध्यक्ष और सभी सम्मानित सदस्यों को उनकी बहुमूल्य जानकारी और सहयोग के लिए तथा नई परियोजनाओं के शुरुआत के साथ-साथ अनुमोदित परियोजनाओं के सुचारु संचालन के लिए आभार और धन्यवाद देती हूँ। केन्द्रीय मूगा एरी अनुसंधान एवं प्रशिक्षण संस्थान के विकास के लिए सहायता प्रदान करने के लिए केंद्रीय रेशम बोर्ड, बेंगलोर के सक्षम प्राधिकारी का भी धन्यवाद करती हूँ। मैं विकास और विस्तार संचार कार्यक्रमों को सभी पूर्वोत्तर भारतीय राज्यों के रेशम विभागों द्वारा सफलतापूर्वक लागू करने के लिए दिये गए समर्थन को ईमानदारी से स्वीकार करती हूँ और उनकी सराहना भी करती हूँ। सहयोगी संस्थानों और अनुसंधान फंडिंग एजेंसियों द्वारा विस्तारित समर्थन की बहुत बहुत सराहना करती हूँ।

के यम वि कुमारि

(डॉ. के. एम. विजयाकुमारी)
निदेशक



FOREWORD

It gives me immense pleasure to bring out the Annual Report for the year 2021-22, which summarizes the activities and achievements of the Central Muga Eri Research and Training Institute (CMER&TI) during the year. We have crossed the two decades of existence of the Institute, serving the stakeholders and being a part of the history of Vanya sericulture growth in Northeast India. There is a deep sense of satisfaction in helping farmers and other stakeholders in enhancing the total Vanya silk production. Several technologies have been developed and successfully transferred to the field. I take this opportunity to acknowledge the hard work of scientists and cooperation of other supporting staff of the Institute, and also the stakeholders who adopted the new techniques. The joint effort has helped in increasing the raw silk production in muga, eri and oak tasar sector.



Though a significant progress has been made in research and development in the area of Vanya sericulture, there is a long way to go to address the burning issues. The changing climate makes the task much more challenging. With these points in mind the Institute has initiated new projects such as breeding high yielding varieties of muga and eri silkworms, developing better host plants of vanya silkworms, studying the effect of climate change on rearing performance, understanding the diseases of vanya silkworms for better management, etc.

The silkworm division has made a significant progress in research and development. A quick and efficient cocoon pre-treatment method to achieve uniform cocoon cooking in muga cocoons with improved reelability and raw silk recovery was developed and is being test verified. Eri chawki rearing technique was standardized. Low cost Eri chawki rearing house with 5000 DFLs brushing capacity was designed and fabricated. By adopting eri chawki rearing technology 20% increase in cocoon yield is expected over conventional rearing. Under muga silkworm improvement programme, one promising muga silkworm line with improved characteristics such as improvement in filament length and fecundity with compact cocoons was shortlisted and test verified under limited trials

The host plant division is working towards the development of perennial castor cultivar and has enriched the castor gene-pool with 28 accessions (22 perennials and 6 annual). These accessions were characterized and a “Descriptor-cum-catalogue” was published for future reference. During the year, 17,435 seedlings of superior Muga and Eri host plants were supplied to 167 beneficiaries. This has supported to augment plantation of superior host plant accessions at farmers’ fields about 40 acres. 35 kg Kesseru seed was supplied to various CSB units across India. Based on the long-term weather and production data for all the districts of Assam a book entitled “Seri-climatic manual of Muga growing districts of Assam” was published.

The biotechnology division is working on various projects that eventually help in improving the Vanya sericulture in Northeast India. The genome and transcriptome data of muga silkworm was integrated into Vanya Silkbase.

The training division has been successful in achieving the target for the year in training the stakeholders including farmers, officials, students and NGO members in new technologies in muga, eri and oak sericulture. The extension division (SEEM) has conducted maximum possible Extension Communication Programmes with wide coverage of farmers. Under SMV programme new rearing technologies have been demonstrated.

The nested units of CMER&TI have been working towards the achievement of their respective targets. RSRS, Imphal has been in forefront on research and extension activities pertaining to oak tasar silkworms. RSRS, Boko, has been catering to the needs of seri-farmers of lower Assam as well as of West Bengal. RECs have achieved the targets for the year, helping farmers in increasing the cocoon production.

I take this opportunity to thank the Chairman and members of Research Advisory Committee for their valuable inputs and support in initiation of new projects as well as smooth running of approved projects. I also thank the Competent Authority of Central Silk Board, Bangalore for providing support for development of the CMER&TI. I sincerely acknowledge and appreciate the support extended by the Department of Sericulture of all Northeastern states in implementing developmental and extension communication programmes. The support extended by the collaborating institutes and research funding agencies is highly appreciated.

(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 situated 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 in Oak tasar sericulture. There is one REC for eri culture located at Fatehpur, Uttar Pradesh.

MANDATE OF THE INSTITUTE

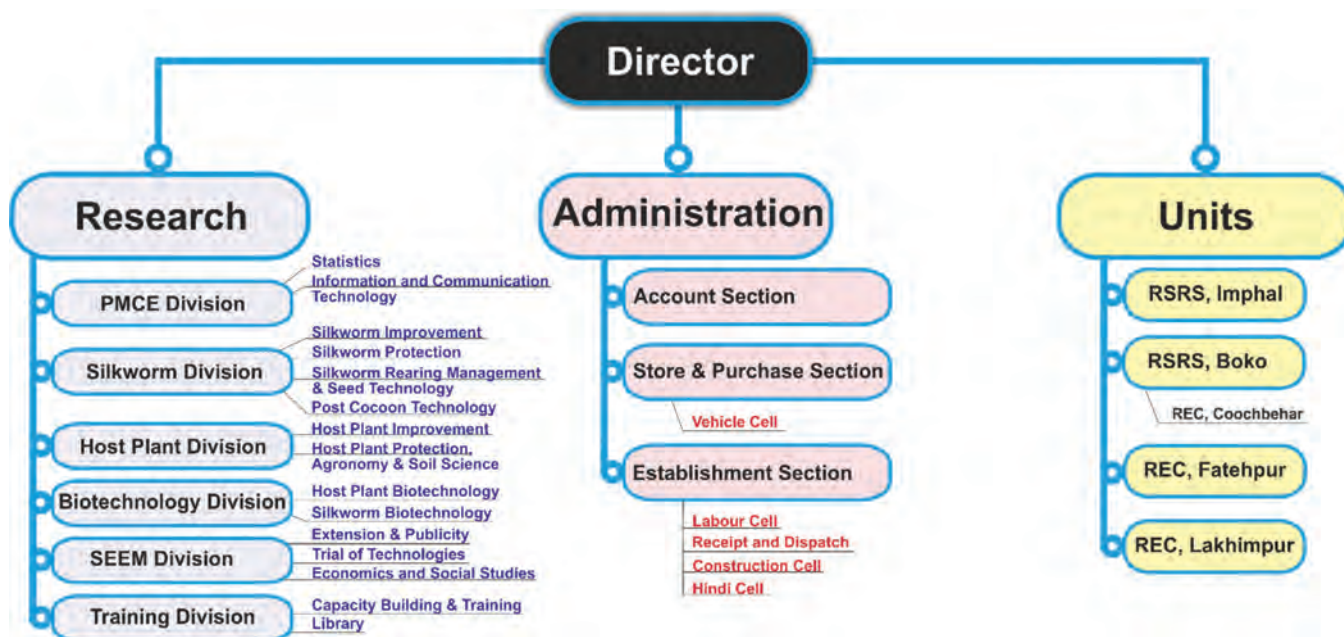
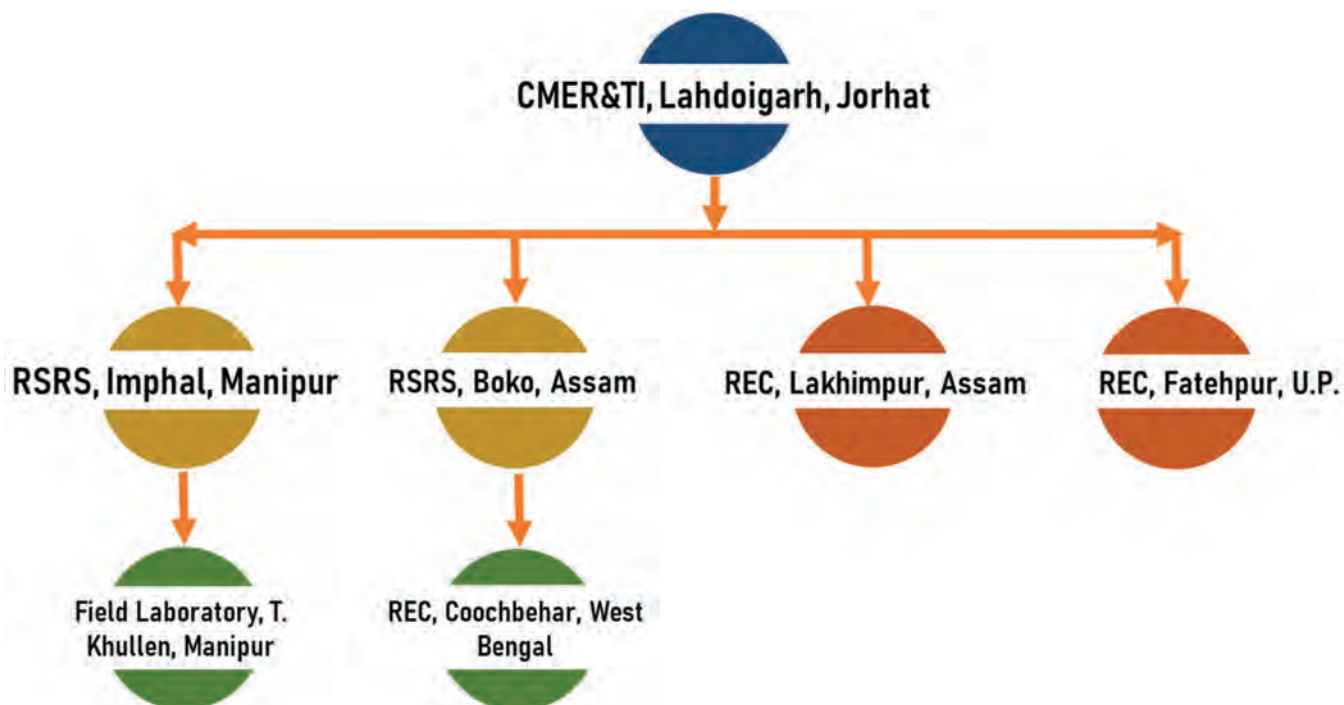
- To act as an apex Research Institute for providing R&D support for muga, eri and oak tasar sericulture.
- To conduct basic, strategic and applied research to increase production and productivity of silkworms and their host plants.
- Improvement of food plants and silkworm eco-races and hybrids.
- To 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 31.03.2022)

Sl. No.	Staff	Main institute	RSRS (Boko+Imphal)	RECs
1	Scientists			
	Scientist-D	4	1+3	2
	Scientist-C	5	1+0	0
	Scientist-B	2	0	1
	Sub-Total	11	5	3
2	STA/ SFA/FA	14	5 +17 = 22	9
3	Administrative staff			
	AD (A&A) & AD (Com)	2+1	0	0
	Asst. Supt	3	2+1	0
	UDC/LDC	05	0	0
	Stenographer	02	0	0
	Ass. Technician	03	2+1	1
	Hindi translator	0	0+1	0
	Driver	1	0+2	0
	MTS	06	4+4	3
	Sub-Total	23	8+9 = 17	4
	G. Total	48	44	16



EXTENSION NETWORK



वैज्ञानिक अमला Scientific Personnel

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

 Dr. KM Vijaya Kumar M.Sc., Ph.D.	Director Specialization: Sericulture cmerti@rediffmail.com cmertilad.csb@nic.in
 Dr. Reeta Luikham M.Sc., Ph.D.	Scientist –D Specialization: Zoology, Sericulture reeta_luikham@rediffmail.com
 Dr. T. James Keisa M.Sc., Ph.D.	Scientist –D Specialization: Zoology, Sericulture Extension jameskeisa@gmail.com
 Dr. Aftab A Shadnam M.Sc., Ph.D.	Scientist –D Specialization: Botany, Plant Breeding, Cytogenetics & Molecular Biology aftab2006@gmail.com
 Dr. M. Chutia M.Sc., Ph.D	Scientist –D (Till 30-06-2021) Sepecialization: Botany, Microbiology mahanaba@yahoo.co.uk
 Dr. DK Gogoi M.Sc., Ph.D	Scientist –D (Till 31-08-2021) Sepecialization: Botany, Microbiology

 Dr. Amit Kumar M.Sc., Ph.D.	Scientist – C Specialization: Botany, Eco-physiology, Climate Change amit_bio80@yahoo.com
 Dr. Arun Kumar KP M.Sc., Ph.D.	Scientist – C Specialization: Insect Breeding, Molecular Biology & Biotechnology arunkumar.kallare@gmail.com
 Dr. Dharmendra K. Jigyasu M.Sc., Ph.D.	Scientist – C Specialization: Environmental Science jigyasudk.csb@gov.in
 Dr. Kh. Subadas Singh M.Sc., Ph.D.	Scientist – C Specialization: Entomology mailsubadas@gmail.com
 Dr. G. Subrahmanyam M.Sc., Ph.D.	Scientist – C (Till 30-06-2021) Specialization: Microbiology
 Dr. Rajal Debnath M.Sc., Ph.D.	Scientist – C (Till 31-07-2021) Specialization: Biotechnology

 Dr. Vijay N M.Sc., Ph.D.	Scientist – C Specialization: Statistics, Sericulture Extension ntvijay@gmail.com
 Dr. Manjunath RN M.Tech., Ph.D.	Scientist – C Specialization: Textile Engineering manjunath.19.n@gmail.com
 Dr. Mahesh DS M.Sc., Ph.D.	Scientist – C Specialization: Sericulture maheshdnpura@gmail.com

Regional Sericulture Research Station(RSRS), Boko, Assam

 Sri. SAS Rahman M.Sc.	Scientist –D Specialization: Sericulture rmrs.boko@gmail.com
 Sri. B. Choudhury M.Sc.	Scientist –D (Till 31-01-2022) Specialization: Sericulture
 Dr. M. Deka M.Sc., Ph. D.	Scientist – C (Till 31-05-2021) Specialization: Sericulture mdeka33@rediffmail.com

 Dr. H. Barman M.Sc., Ph. D.	Scientist – C Specialization: Sericulture hbarmancsb.csb@gov.in
---	--

Regional Sericulture Research Station (RSRS), Imphal, Manipur

 Dr. Y. Debaraj M.Sc., Ph. D.	Scientist –D Specialization: Sericulture rtrsimp.csb@nic.in yumdebnamraj@gmail.com
--	--

 Dr. L. Somen M.Sc., Ph.D.	Scientist – D Specialization: Sericulture somen_laishram@yahoo.com
--	---

 Dr. S. Subharani Devi M.Sc., Ph.D.	Scientist – C Specialization: Sericulture drsubharani@gmail.com
--	--

REC, Lakhimpur, Assam

 Dr. Diganta Mech M.Sc., Ph.D.	Scientist –D dmechcsb@gmail.com
---	---

REC, Coochbehar, West Bengal

 Dr. O. P. Patidar M.Sc., Ph.D.	Scientist – B Specialization: Botany, Plant Breeding, Cytogenetics coochbeharrec@gmail.com oppatidar28@gmail.com
--	--

REC, Fatehpur, Uttar Pradesh

 Sh. Suraj Pal M.Sc.	Scientist –D Specialization: Sericulture fatehpur.erec@gmail.com surajpal581@gmail.com
---	--

DELEGATED AND NON-DELEGATED UNITS OF CMER&TI**Delegated Units**

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

Regional Sericulture Research Station, Boko, Kamrup, Assam (up to Aug., 2021)

Regional Sericulture Research Station, Imphal, Manipur (up to Aug., 2021)

Non-Delegated Units

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

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

Research Extension Centre, Coochbehar, West Bengal

Research Extension Centre, Lakhimpur, Assam

Research Extension Centre, Fatehpur, Uttar Pradesh



अनुसंधान सलाहकार समिति RESEARCH ADVISORY COMMITTEE

अध्यक्ष Chairman

Prof.P.J. Handique,

Vice Chancellor, Gauhati University, Guwahati-781014 (Assam)

Email: pjh@gauhati.ac.in/secytovc@gauhati.ac.in

सदस्य Members

Prof. L.K. Hazarika

Retired Professor & Head, Department of Entomology, Assam Agricultural University, Jorhat-785101 (Assam), Email: lkazarika@yahoo.com

Dr. Bidyut Kumar Sarmah

Director, DBT-AAU Centre, Assam Agricultural University, Jorhat – 785103 (Assam)
Email: bidyutsarmah@aaau.ac.in

Prof. Pradip K. Neog

Director, Extension Education Institute (NE Region), Assam Agricultural University, Jorhat-785103 (Assam), Email: pradipkneog@gmail.com

Dr. B.K. Singh

Rtd. Director (CMER&TI, Lahdoigarh), Tarun Nagar, Bye lane-5, House No. 8, Dispur, Guwahati-781005 (Assam) Email: bijoykumars87@gmail.com

The Commissioner

Handloom, Textiles & Sericulture, Govt. of Assam, Dispur, Secretariat, Guwahati – 781006 (Assam), Email: hmarzaylas@ansam.gov.in

The Commissioner & Secretary Sericulture

Dept. Govt. of Nagaland, New Secretariat Complex, Kohima – 797001 (Nagaland),
Email : keniloapon@gmail.com

The Director of Sericulture

Govt. of Manipur, Project Management Complex Sangalpat, Imphal East, Imphal-795004 (Manipur),
Email: dosmanipur@gmail.com

The Commissioner

Textiles & Handicrafts, Govt. of Arunachal Pradesh, Secretariat Office, Itanagar-791111 (Arunachal Pradesh),
Email: taggutahang@hotmail.com

The Commissioner & Secretary

Sericulture and Weaving, Govt. of Meghalaya, Additional Secretariat Building, Shillong-793001 (Meghalaya)

Sri Robin Bharali

Rearer Representative, Sericulture Farmer, Sivasagar-785640 (Assam)

Mr. Kaustav Borbora

Reeler Representative, Silk Culture, Jorhat-785 101 (Assam), Email: kvb@silkculture.in

The Scientist-D & Head

Muga Silkworm Seed Organization (MSSO), CSB, Khanapara Post, Guwahati – 781 002 (Assam)
E-mail: mssoguw.csb@nic.in

The Director (Tech)

Central Silk Board, CSB Complex, BTM Layout Madiwala, Bengaluru – 560 068 (Karnataka)
E-mail: dirtech.csb@nic.in

The Scientist-D & Head

Research Coordination Section, Central Silk Board, CSB Complex BTM Layout, Madiwala, Bengaluru – 560 068 (Karnataka)

Member Convener

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



उपलब्धियों की मुख्य विशेषताएं (2021–22)

2021–22 के दौरान, 21 अनुसंधान परियोजनाएं चलाई गईं, जिनमें से 03 परियोजनाएं डीबीटी वित्त पोषित हैं, 02 परियोजनाएं डीएसटी वित्त पोषित हैं और शेष सी.एस.बी. वित्त पोषित हैं। दो परियोजनाएं का कार्य पूरा कर लिया गया है, 03 नई परियोजनाओं की शुरुआत की गई और शेष 16 परियोजनाएं पिछले वर्ष से जारी हैं। सभी अनुसंधान परियोजनाएं अलग-अलग श्रेणीकरण के अंतर्गत हैं, जैसे पर्यावरण संबंधी चुनौतियां और ग्लोबल वार्मिंग, कठिन परिश्रम में कमी और महिलाओं के अनुकूल प्रौद्योगिकियां, इनपुट लागत में कमी, पर्यावरण के अनुकूल और जैविक खेती, मेजबान संयंत्र और रेशमकीट सुधार आदि। शोध कार्यों का एक संक्षिप्त विवरण इस प्रकार नीचे प्रस्तुत है:

मेजबान पौधा सुधार, उत्पादन और संरक्षण

- ❖ अरंडी जीन पूल की 28 परिग्रहण (22 बारहमासी और 6 वार्षिक) पौधों से समृद्ध किया गया है। मॉर्फो-मीट्रिक, बायोकेमिकल, बायोएसे और सीड मॉर्फो-मेट्रिक लक्षणों के आधार पर "लक्षण वर्णन" पूरा कर लिया गया। परिग्रहण-22 को पत्ती की उपज और अन्य योगदान मापदंडों के संदर्भ में आशाजनक अरंडी पौधे परिग्रहण के रूप में पहचाना गया है।
- ❖ बेहतर विशेषताओं के साथ एक बारहमासी अरंडी पौधे की किस्म को विकसित करने के उद्देश्य से चयनित संभावित बारहमासी प्रजातियों और खेती की गई प्रजातियों को 29 विभिन्न क्रॉस संयोजनों द्वारा देखा गया है।
- ❖ इस वर्ष के दौरान 167 लाभार्थियों को सुपीरियर मूगा और एरी खाद्य/होस्ट पौधों के 17435 पौधों की आपूर्ति की गई। इसने लगभग 40 एकड़ खेतों के लिए बेहतर खाद्य/होस्ट पौधों के रोपण को बढ़ाने में सहायता मिलेगी। पूरे भारत में विभिन्न केंद्रीय रेशम बोर्ड की इकाइयों को 35 किलोग्राम केसेरु बीज की आपूर्ति की गई।
- ❖ मेबो रिजर्व वन क्षेत्र, अरुणाचल प्रदेश में मूगा इन-सीटू संरक्षण गतिविधियों के लिए डीओएस, अरुणाचल प्रदेश और वन विभाग, अरुणाचल प्रदेश के साथ समझौता ज्ञापन निष्पादित किया।
- ❖ दीमापुर (नागालैंड) में वन्या रेशम उत्पादन की भूमि के उपरी मिट्टी के पोषण स्थिति का आकलन किया गया और सूक्ष्म और मैक्रो पोषक तत्वों की उपलब्धता को दर्शाने के लिए स्थानिक वितरण मानचित्र तैयार किए गए। गुणवत्ता वाले मुगा और एरी कोकून की कटाई के लिए पोषक तत्वों की कमी वाली मिट्टी को समृद्ध करने के लिए सुधारात्मक उपाय सुझाए गए थे।
- ❖ असम के जिला के और मूगा फसल वार दीर्घावधि (1981–2018) मौसम पैरामीटर आंकड़े को संसाधित किया गया था और एक मैनुअल भी तैयार किया गया था जो असम के छात्रों, उद्यमियों, वैज्ञानिकों और नीति निर्माताओं के लिए एक संदर्भ के रूप में काम करेगा और गुणवत्ता में मदद करेगा तथा बदलते पर्यावरणीय परिदृश्य के संबंध में मूगारेशम कीट पालन को बढ़ावा करने का निर्णय लेने में सहायता मिलेगी।

रेशमकीट सुधार, उत्पादन और संरक्षण

- ❖ मूगा रेशमकीट सुधार कार्यक्रम के तहत, 500 मीटर से अधिक फिलामेंट लंबाई, कॉम्पैक्ट कोकून और 250 से ऊपर उर्वरता जैसी उन्नत विशेषताओं वाली एक आशाजनक मूगा रेशमकीट प्रजाति को सीमित परीक्षणों के तहत सूचीबद्ध किया गया और परीक्षण के सत्यापित भी किया गया। आगामी व्यावसायिक सीजन में चयनित लाइनों का बड़े पैमाने पर परीक्षण किया जाएगा।
- ❖ एरी रेशमकीट सुधार कार्यक्रम के तहत, अंतर और अंतर-विशिष्ट संकरण कार्यक्रम में उपयोग के लिए उत्तर पूर्व क्षेत्र से जंगली एरी रेशमकीट, सामिया कैनिंगी को एकत्र किया गया। उन्नत संकर/नस्लों के चयन के लिए 20 क्रॉस कॉम्बिनेशन (इंटर और इंट्रा-स्पेसिफिक) किए गए।

- ❖ 90,000 डीएफएल प्रति हेक्टेयर प्रति वर्ष पालन करने के लिए एरी चौकी कीट पालन तकनीक को 6 प्लॉट मॉड्यूल के साथ मानकीकृत किया गया था। 5000 डीएफएल ब्रशिंग क्षमता वाले कम लागत वाले एरी चौकी कीटपालन गृह का डिजाइन और निर्माण किया गया। क्षेत्र परीक्षण और प्रदर्शन आयोजित किए गए। पारंपरिक पालन की तुलना में कोकून उपज में 20%से अधिक की वृद्धि दर्ज की गई।
- ❖ बेहतर रीलेबिलिटी और रॉ सिल्क रिकवरी के साथ मूगा कोकून में समान कोकून पकाने के लिए एक त्वरित और कुशल कोकून पूर्व-उपचार विधि विकसित की गई थी और इसका परीक्षण सत्यापित किया जा रहा है।
- ❖ प्रतिकूल मौसमों (पूर्व-बीज और बीज फसलों) के दौरान बीज की उपलब्धता में सुधार के लिए मूगा में कोल्ड रीलिंग तकनीक का मानकीकरण किया गया। तकनीक कोमूगा एरी रेशमकीट बीज संगठन (एमइएसएसओ) गुवाहाटी के समन्वय से मान्य किया जा रहा है।
- ❖ आरएसआरएस, इंफाल ने वसंत फसल 2022 के दौरान आगे गुणन के लिए 81.51% उपलब्धि के साथ ओक टसर के 25,270 डीएफएल का उत्पादन किया और राज्य सरकार और एसआरको आपूर्ति किया गया।
- ❖ आरएसआरएस इंफाल में ओक टसर रेशमकीट की तीन प्रजातियों ए. प्रोयली, ए. पेर्नी, ए. फ्रिथी और 09 विकसित नस्लों को रखा गया था। एरी और मूगा रेशमकीटों की तीन पारि-प्रजातियों का भी अनुरक्षण किया जा गया।
- ❖ काले कपड़े से ढकी बांस की टोकरी के अंदर एंथेरिया फ्रिथी का ग्रैनेज किया गया जिसमें 52–54% प्राकृतिक युग्मन पाया गया। मोनिया के अंदर किए गए ग्रैनेज से 225 अंडों की उच्चतम औसत उर्वरता दर्ज की गई। 14 घंटे युग्मन के लिए रखे जाने पर 75 से 82% अंडों से हैचिंग दर्ज की गई।
- ❖ एंथेरिया प्रोयली के गर्मी प्रेरित पांचवें इंस्टार लार्वा के प्रोटीन प्रोफाइलिंग का अध्ययन किया गया जिसमें 5 प्रमुख प्रोटीन बैंड पाया गए जो 15% एसडीएस-पेज के माध्यम से उच्च आणविक भार वाले हैं। हीट शॉक प्रोटीन hsp 19.9, 21, 60, 70, 90 की अभिव्यक्ति दिखाता है जो तापमान के साथ बढ़ता या घटता है।
- ❖ मणिपुर की विभिन्न कृषि-जलवायु परिस्थितियों के लिए उपयुक्त विभिन्न एरी इको रेस, उपभेद और नस्लों को बनाए रखा गया है।
- ❖ सबसे अधिक ईआरआर कम ऊंचाई में बोर्डुआर (84.66%) और C2 नस्ल (84.42%) में दर्ज की गई। उच्च ऊंचाई में भी यह उच्च रेशम अनुपात के साथ बोर्डुआर (81.5%) और C2 (80%) दोनों में लगभग बराबर प्राप्त हुआ। सभी उपभेदों के बीच, पीला प्लेन और हरा-नीला प्लेन, दोनों कीटपालन स्थलों में उच्च ईआरआर मिला है, यानी, क्रमशः कम ऊंचाई (वाईपी-82% और जीबीपी-77%) और उच्च ऊंचाई (वाईपी-80% और जीबीपी-75%) प्राप्त हुआ है।
- ❖ मानकीकृत मेजबान पौधे के वाष्पशील मिश्रणों द्वारा मूगा और एरी रेशमकीटों की अंडे देने की क्षमता क्रमशः 15–18% और 14–16% तक बढ़ी हुई मिली है। ऑन-स्टेशन परीक्षणों के माध्यम से प्रौद्योगिकी का सत्यापन प्रगति पर है।

विस्तार, क्षमता निर्माण और प्रशिक्षण

- ❖ संस्थान द्वारा तीन वन्या रेशम कृषि मेलों, 03 कार्यशालाओं, 08 प्रदर्शनियों, 06 फील्ड दिवसों, 22 जागरूकता कार्यक्रमों और 20 प्रौद्योगिकी प्रदर्शन कार्यक्रमों का आयोजन किया गया। वर्ष के दौरान इन कार्यक्रमों के माध्यम से लगभग 3238 व्यक्तियों को जागरूक किया गया।
- ❖ कुल 1740 किसानों, अधिकारियों, छात्रों और एनजीओ सदस्यों को किसान कौशल प्रशिक्षण, प्रौद्योगिकी उन्मुखीकरण कार्यक्रम, पोस्ट कोकून सेक्टर के तहत प्रशिक्षण, रेशम उत्पादन संसाधन केंद्र के तहत प्रशिक्षण और

गैर-सीबीटी वित्त पोषित प्रशिक्षण जैसे पांच अलग-अलग प्रशिक्षण घटकों के तहत प्रशिक्षित/कुशल बनाया गया। समर्थ योजना के तहत 217 लाभार्थी किसानों को कपड़ा क्षेत्र में प्रशिक्षित भी किया गया।

- ❖ इस वर्ष के दौरान ऑन-स्टेशन परीक्षणों के माध्यम से 08 नई विकसित प्रौद्योगिकियों का परीक्षण सत्यापित किया गया और 12 प्रौद्योगिकियों का ऑन-फार्म परीक्षणों के माध्यम से परीक्षण किया गया।
- ❖ कीट पीड़क के प्रकोप के नियंत्रण के लिए जैव-कीटनाशकों के उपयोग क्यू सेराटा को 03 स्थानों पर ऑन-स्टेशन परीक्षणों के माध्यम से सत्यापित किया गया था। बायोनीम के प्रयोग के 14वें दिन कीटों के प्रकोप में 70-72% की कमी दर्ज की गई।
- ❖ गर्मियों के दौरान 03 ठंडे स्थानों पर मूंगा रेशमकीट का पालन किया गया और नियंत्रण के मुकाबले 25% कोकून उपज हासिल की गई। गर्मियों के दौरान ठंडे क्षेत्रों में मूंगा की खेती से उपज और बीज की उपलब्धता में सुधार होगा।
- ❖ प्रौद्योगिकी हस्तांतरण कार्यक्रम के तहत 9.60 एकड़ के कुल क्षेत्र में वृक्षारोपण के लिए ऊपरी और निचले असम क्षेत्रों में केसेरू पौधे की श्रेष्ठ प्रजातियों को लोकप्रिय बनाने के लिए चयनित एरी किसानों को केसेरू परिग्रहणों (एचएफ005 और एचएफ008) के 4320 पौधों की आपूर्ति की गई। 7.78 एकड़ भूमि में ब्लॉक वृक्षारोपण करने के लिए चयनित एरी कल्चर किसानों के बीच 3505 बोरपत पौधे भी वितरित किए गए।
- ❖ उन्नत तकनीकों को अपनाने और एरी कल्चर में कौशल विकास के माध्यम से अपनाए गए किसानों की घरेलू आय में 50% तक की वृद्धि हुई। इंटरक्रॉपिंग अप्रोच (अदरक, अरबी आदि) के माध्यम से एरी कल्चर के विविधीकरण और कृषि उपयोग के लिए कूड़े और कचरे के उपयोग से घरेलू आय में 64% तक की वृद्धि हुई है।

संस्थान के प्रकाशन संग्रह

- ❖ 2021-22 के दौरान, सीएमईआरएंडटीआई ने राष्ट्रीय और अंतर्राष्ट्रीय समकक्ष समीक्षा पत्रिकाओं में 26 शोध पत्र, 03 तकनीकी पत्रक/बुलेटिन और 06 पुस्तकें/पुस्तक अध्याय प्रकाशित किए।
- ❖ संस्थान की प्रौद्योगिकियों पर 03 वीडियो फिल्में भी तैयार की गईं और 112 पोस्ट सोशल मीडिया प्लेटफॉर्म पर साझा की गईं। संस्थान के प्रकाशनों का संचयी NAAS और इम्पैक्ट फैक्टर क्रमशः 190.50 और 77.31 था।

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 (जर्नल ऑफ एप्लाइड बायोलॉजी एंड बायोटेक्नोलॉजी) पर विशेष अंक।
- डॉ. टी. जेम्स कीसा, सदस्य बोर्ड ऑफ अंडरग्रेजुएट स्टडीज, मणिपुर विश्वविद्यालय
- डॉ अरुण कुमार – संपादक, सदस्य वैज्ञानिक सलाहकार बोर्ड, इंटरनेशनल जर्नल वाइल्ड सिल्कमोथ एंड सिल्क
- डॉ. अमित कुमार, संपादक, भूमि (3.3); पर्यावरण विज्ञान में फ्रंटियर्स (4.5)
- डॉ. अमित कुमार, संपादक, माइक्रोबियल टेक्नोलॉजी फॉर क्लाइमेट रेजिलिएंट एग्रीकल्चर (सिंगर, स्विट्जरलैंड)



HIGHLIGHTS OF ACHIEVEMENTS (2021-22)

During 2021-22, 21 research projects were carried out, of which 03 projects are DBT funded, 02 projects are DST funded and remaining are CSB funded. Two projects were concluded, 3 were newly initiated and remaining 16 projects are being continued from previous year. All the research projects are under different categorization viz., Environmental challenges and global warming, Drudgery reduction and women friendly technologies, Input cost reduction, Eco-friendly & organic farming, Host plant and Silkworm improvement etc. A brief highlight of the research works is presented below:

Host Plant Improvement, Production and Protection

- ❖ Castor gene pool was enriched with 28 accessions (22 perennials and 6 annual). Characterization on Morpho-metric, biochemical, bioassay and seed morpho-metric traits was completed. Accession-22 was identified as promising accession in-terms of leaf yield and other contributing parameters.
- ❖ Selected potential perennial accessions and cultivated accessions were crossed in 29 different cross combinations with an aim to develop a perennial castor variety with improved characteristics.
- ❖ During the year 17,435 seedlings of Muga and Eri host plants were supplied to 167 beneficiaries. This has supported to augment plantation of superior host plant accessions at farmers' fields about 40 acres. 35 kg Kesseru seed was supplied to various CSB units across India.
- ❖ Executed MoU with DOS and Forest Dept. of Arunachal Pradesh for Muga in-situ conservation activities at Mebo Reserve Forest area.
- ❖ Nutritional status of vanya sericulture top soils in Dimapur (Nagaland) 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.
- ❖ The district and crop wise long term (1981-2018) weather parameters data of Assam was processed and a manual was prepared which 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.

Silkworm Improvement, Production and Protection

- ❖ Under muga silkworm improvement programme, one promising muga silkworm line with improved characteristics such as above 500-meter filament length, compact cocoons and fecundity above 250 was shortlisted and test verified under limited trials. Large scale trials of the selected lines will be carried out in forthcoming commercial season.
- ❖ Under eri silkworm improvement programme, collected wild eri silkworm, *Samia canningi* from NE region for utilization in inter and intra-specific hybridization programme. 20 cross combinations (Inter and intra-specific) were carried out for selection of improved hybrids/breeds.
- ❖ Eri chawki rearing technique was standardized with 6 plot module to brush 90,000 DFLs/hectare/year. Low cost Eri chawki rearing house with 5000 DFLs brushing capacity was designed and fabricated. Field

testing and demonstrations were conducted. More than 20% increase in cocoon yield was recorded over conventional rearing.

- ❖ A quick and efficient cocoon pre-treatment method to achieve uniform cocoon cooking in muga cocoons with improved reelability and raw silk recovery was developed and is being test verified.
- ❖ Cold reeling technique in muga was standardized for improving seed availability during unfavorable seasons (pre-seed & seed crops). The technique is being validated in coordination with MESSO, Guwahati.
- ❖ RSRS, Imphal produced 25,270 dfls of Oak Tasar with 81.51% achievement and supplied to State govt. and ASRs for further multiplication during spring crop 2022.
- ❖ Three species of Oak tasar silkworm *A. proylei*, *A. pernyi*, *A. frithi* and 09 evolved breeds were maintained at RSRS Imphal. Three eco-races of eri and muga silkworms were also maintained.
- ❖ Rearing performance of *Antheraea frithi* on different food plants during first and second crops showed highest cocoon yield of 43 and 41 cocoons per dfl respectively when fed on *Lithocarpus dealbata* followed by worms reared on *Quercus serrata* and *Quercus griffithi*.
- ❖ Grainage performance of *Antheraea frithi* was recorded, 52-54% natural coupling was found with the moths released inside the bamboo basket covered with black cloth. The highest average fecundity of 225 eggs was recorded when the moths were allowed to lay eggs inside monia. 75 to 82% egg hatching was recorded when moths were allowed for 14hrs of coupling.
- ❖ Protein profiling studies of heat induced fifth instar larvae of *Antheraea proylei* showed 5 major protein bands which are having high molecular weight through 15% SDS-PAGE. Detection of Heat Shocked Proteins showed expressions of hsp19.9, 21, 60, 70, 90 which increase or decrease with temperature.
- ❖ Different eri eco races, strains and breeds suitable for different agro-climatic conditions of Manipur were maintained. Highest ERR was recorded at par on Borduar (84.66 %) and C2 breed (84.42 %) in low altitude. In high altitude also it was almost at par in both Borduar (81.5 %) and C2 (80 %) with higher SR %. Among the strains, Yellow plain and Greenish blue plain, showed with higher ERR in both the rearing sites, i.e., in low altitude (YP-82 % & GBP-77 %) and in high altitude (YP-80 % & GBP-75 %) respectively.
- ❖ Egg laying capacity of Muga and Eri silkworms was enhanced by 15-18% and 14-16%, respectively by standardized host plant volatile blends. Validation of technology through on-station trials is in progress.

Extension, Capacity Building & Training

- ❖ Three Vanya Resham Krishi melas, 03 workshops, 08 exhibitions, 06 Field Days, 22 awareness programmes and 20 technology demonstration programmes were organized by the Institute. About 3238 persons were sensitized through these programmes during the year.
- ❖ A total of 1740 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 and Non-CBT funded trainings. 217 beneficiary farmers were also trained in Textile Sectors under “SAMARTH” scheme

- ❖ During the year 08 newly developed technologies were test verified through on-station trials and 12 technologies were tested through on-farm trials.
- ❖ Use of Bio-pesticides for control of insect pest infesting *Q. serrata* was test verified through on-station trials at 03 locations. 70-72% reduction of pest infestation on 14th day after application of Bioneem was recorded.
- ❖ Rearing management of muga silkworm in cooler regions during summer was carried out at 03 cooler locations and 25% cocoon yield gain was achieved as against control. Rearing of muga in cooler areas during summer will improve the yield and seed availability.
- ❖ 4320 seedlings of Kessuru accessions (HF005 and HF008) were supplied to selected Eri farmers for popularization of these superior accessions in upper and lower Assam with a total area plantation of 9.60 acres under TOT programme. 3505 Borpat seedlings were also distributed among selected Eri culture farmers for raising block plantations in 7.78 acres of land.
- ❖ Household income of adopted farmers increased upto 50% through adoption of improved technologies and skill development in eri culture. Diversification of eri culture through intercropping approach (Ginger, Colocasia etc.) and use of litter and wastes for agriculture use has increased the household income upto 64%.

Publication of Institute

During 2021-22, CMER&TI published 26 research papers in National and international peer reviewed journals, 03 technical bulletin and 06 books/booklet/book chapters. 03 video films on technologies of the Institute were also prepared and 112 posts were shared on social media platform. Cumulative NAAS and Impact factor of Institute publications was 190.50 and 77.31, respectively.

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 Silkworm 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 2021-22

Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
1	MOE 05003 EF	Socio-economic uplifting of farmers through adoption of improved technologies and skill development in eri culture- (DST funded)	Sept., 2018 - Aug, 2021	Dr. H Barman	Sri SAS Rahman
2	APS 05001EF	Development of technology for enhancing egg laying in Vanya Silk moths by application of host plant volatiles (in collaboration with SSTL, Kodathi) (DBT funded)	June, 2018- May, 2021 Extended upto Sept., 2021	Dr. Dip Kr. Gogoi, (upto Aug, 2021) Dr. T. James Keisa (From Sept, 2021)	-
Concluded as CI					
3	CYF 07010MI	Grading of Muga silk yarn- Development of methods and procedure (in collaboration with CSTRI, Bangalore) (CSB funded)	June, 2019- Nov., 2021	Dr. Prakash Bhat	Dr. Ravi Kumar, Dr. Manjunath R N

नैरंतरिक परियोजनाएं ON GOING RESEARCH PROJECTS:

Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
1	MOE 05004EF	Adoption of improved sustainable technologies of muga culture for elevation of cocoon production in the tribal belt of Assam (DST funded)	Aug., 2019- July, 2022	Dr. Vijay N	Dr. Dip Kumar Gogoi (upto Aug. 2021), Dr. D. Mech, Sri. SAS Rahaman, Dr. K Sathyanarayana
2	PIB 05005SI	Genetic enhancement of Castor (<i>Ricinus communis</i> L.) germplasm as a source material for development of productive perennial varieties (CSB funded)	Oct., 2019- Sept., 2022	Dr. Aftab A. Shabnam	Dr. Amit Kumar, Dr. D. K. Jigyasu, Dr. L. Somen Singh
3	AIB 05006SI	Breeding of muga silkworms for improved silk quality and disease tolerance (CSB funded)	Oct., 2019- Sept., 2022	Dr. Arun Kumar K.P	Dr. Mahesh D.S., Dr. Manjunath R.N.

Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
4	APR 05007SI	Standardization of chawki rearing practices for Eri silkworm, <i>Samia ricini</i> (Donovan) (CSB funded)	Oct., 2019- Sept., 2022	Dr. Mahesh D.S.	Dr. Arun Kumar K.P., Dr. K. Subadas Singh
5	APR 05008SI	Standardization of Rearing and Grainage Technologies of <i>Antheraea frithi</i> Moore (CSB funded)	Oct., 2019- Sept., 2022	Dr. L. Somen Singh	Dr. S. Subharani Devi
6	AIB 05009SI	Isolation of thermo-tolerant line(s) of oak tasar silkworm <i>Antheraea proylei</i> J (CSB funded)	Oct., 2019- Sept., 2022	Dr. Y. Debaraj	Dr. S. Subharani Devi
7	APR 05010SI	Evaluation of eri silkworm races suitable for different agro-climatic conditions of Manipur (CSB funded)	Oct., 2019 to Sept., 2022	Dr. Y. Debaraj	Dr. L. Somen Singh
8	AIT 05011EF	Molecular investigation into the ligno-cellulolytic system of a few wild silkmoth in North East India) (Collaboration with NEIST, Jorhat) (DBT funded)	Oct., 2019 to Sept., 2022	Dr. Arun Kumar KP	Dr. Rajal Debnath, CI Dr. Dip. K. Gogoi, CI
9	AIB 05012SI	Inter and intra-specific hybridization for improvement of eri silkworm, <i>Samia ricini</i> Donovan. (CSB funded)	Mar., 2020- Feb., 2024	Dr. Reeta Luikham	Dr. Aftab Ahmad Shabnam
10	AIP 05013SI	Impact of elevated CO ₂ and temperature on muga silkworm and its primary host plant. (CSB funded)	Mar., 2020- Feb., 2023	Dr. Amit Kumar	Dr. Aftab Ahmad Shabnam, Dr. D. K. Jigyasu
11	BPP 05014CN	Standardization of Processing and Production of a Consumable Beverage from Mulberry Leaves and Blending Green Tea (collaboration with CSR & TI, Mysore/ TTRA, Tocklai/ AAU, Jorhat) (CSB funded)	Mar., 2020- June, 2021 (extended up to	Dr. K. Sathyanarayana	Dr. M Chutia, Dr. P Sangannavaer, Dr. P Kumerasen
12	ARP 05015SI	Development of chemical based control measures for management of pebrine disease in Muga silkworm, <i>Antheraea asamensis</i> Helfer (CSB funded)	Jan., 2021- Dec., 2023	Dr. Arun Kumar KP Dr. G. Subrahmanyam (up to 30.06.2021)	-

Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
13	AIT 05016MI	Integrating genomic and transcriptomics resources for functional insight into the biology of Muga Silkmoth <i>Antheraea assamensis</i>	Jan., 2021- Dec., 2023	Dr. Arun Kumar KP	Dr. Rajal Debnath, CI
14	CFC 5017MI	Exploration and adoption of novel muga cocoon cooking technology for increasing its reelability and raw silk quality (collaboration with CSTRI, Bangalore) (CSB funded)	Mar., 2021- Feb., 2023	Dr. Manjunath R.N.	Dr. D. K. Gogoi, Dr. Rajiv K. Munshi
15	APR 05018MI	Effect of various host plants separately and in combination on Rearing and grainage performance of Muga silkworm, <i>Antheraea assamensis</i> Helfer (collaboration with MSSO, Guwahati and RSRS Boko) (CSB funded)	Mar., 2021- Feb., 2024	Dr. Kh. Subadas Singh	Sri. SAS Rahman, Dr. D. K. Jigyasu, Dr. M. Deka (upto 31.05. 2021), Dr. Vikram Kumar
16	MFM 5019MI	Development of honeycomb mountages and harvesting technology for muga Cocoon production with improved uniformity and raw silk recovery (collaboration with MSSO, Guwahati) (CSB funded)	Mar., 2021 to Feb., 2023	Dr. Manjunath R.N.	Dr. Urmimala Hazarika
17	APS 05020MI	Commercial egg production technology for eri-culture (collaboration with EBSF, MESSO, Topatoli) (CSB funded)	Feb., 2022- Jan., 2024	Dr. Mahesh D.S	Dr. Arun Kumar K.P., Dr. Lalita Natrajan
18	APS 05021EF	Studies on population diversity and role of host plant volatiles cues for enhancing egg laying in temperate tasar silk moth (<i>Antheraea proylei</i>) (collaboration with CMER&TI, Lahdoigarh, Manipur University & IIHR, Bengaluru) (DBT funded)	Jan., 2022- Dec., 2024	Dr. Sinam Subharani Devi	Dr. K. M. Vijaya Kumari
19	MOE 05022MI	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	Feb., 2022- Jan., 2024	Dr. D K Jigyasu	Shri Suraj Pal, Dr. James T Keisa, Dr. Yumnam Debaraj, Dr. L. Somen Singh,

Sl.	Code	Title	Duration	Principal Investigator	Co-Investigator
		CMER&TI & MESSO (CSB funded)			Sri. Bidyut Nath Choudhury, Sri SAS Rahman, Dr. Diganta Mech, Dr. Aftab A Shabnam, Dr. Sinam Subharani Devi, Dr. Arun Kumar KP, Dr. Amit Kumar, Dr. Kh. Subadas Singh, Dr Vijay. N., Dr. Mahesh D S, Dr. Manjunath R N, Dr. Abhishek Singh
Projects as Co-I in Other Institutes					
1	BPS 01013CN	Utilization and diversification of silkworm pupae products for human & animal consumption and composting. (CSB funded)	Sept., 2020 - Aug, 2022	Dr. Mahesh D.S.	Dr. T. James Kiesa
2	CYF 7014MI	Development of 3D woven silk fabrics and their applications (In collaboration with CSTRI, Bangalore) (CSB funded)	July, 2020- June, 2022	Dr. H. S. Hambulingappa	Dr. Manjunath R.N.



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

रेशमकीट विभाग SILKWORM DIVISION



ON GOING 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)** : 2.40 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 silkworm samples.
2. Classical breeding studies to select better lines for muga silkworms.
3. Mass production for limited trials.

Summary of the findings/achievements:

Characteristics of wild and cultivated stock of muga silkworms

- Wild muga silkworm samples were collected during different seasons and from various locations either in larval stage or in cocoon stage. The wild samples were clearly distinguished from cultivated lines based on several features as listed in Figure 1.
- One of the main distinguishing characteristics of wild muga is its ability to hibernate during unfavorable seasons including winter and summer. In nature muga seems to be bi or trivoltine in nature, where it completed one or two life cycles during April – June and one life cycle during October-November season while staying in hibernation during the remaining periods.
- It was tried to get insights into genomic characteristics of wild muga in comparison with cultivated stock to know if there is any genomic signature that could be obtained which clearly distinguishes the wild from cultivated stock. As you see from the Table 1, there is a clear distinction in heterozygosity rate both in SNPs and also in Indels, in which there is almost ten times more heterozygosity in wild compared to cultivated stock. This probably correlates to the better breeding characteristics (cocoon characteristics and fecundity) that is often observed in wild muga and possible erosion of these characters in cultivated muga due to repeated selfing and resulting reduction in heterozygosity. The fitness which though is not experimentally measured in this project seems to be affected in cultivated muga due to reduced heterozygosity.

Genotyping by sequencing (GBS) based large scale genotyping of wild and cultivated muga to get insights into genetics and genomics of muga silkworm

- The collection of wild muga samples that hibernated in pupal stage during winter season led us to further investigate if there are any genetic and genomic signatures that exist between wild and cultivated genetic stocks. The wild samples were collected from Manipur (Imphal district), Arunachal Pradesh (Pasighat area) and Assam (Jorhat) and pupal hibernation during winter was confirmed in grainage and the DNA was isolated individually from selected males and females. GBS based large scale genotyping was carried out and data was analyzed. The analysis revealed that the wild muga, irrespective of place of collection was highly heterozygous in nature. Very little heterozygosity was observed in the cultivated stock, which probably is the reason behind reduced yield after several inbreeding cycles in the cultivated stock (Table 1). In basic seed farms, every year wild cocoons should be used as one of the parents and seeds should be prepared by crossing wild to cultivated stock to bring in variability and increase the level of heterozygosity. This will improve the vigor in subsequent rearing and finally a good commercial crop may be expected from this stock. Genome wide association studies (GWAS) using the generated data is ongoing. GWAS will provide more insights into locus/loci linked to hibernation behaviour in muga.

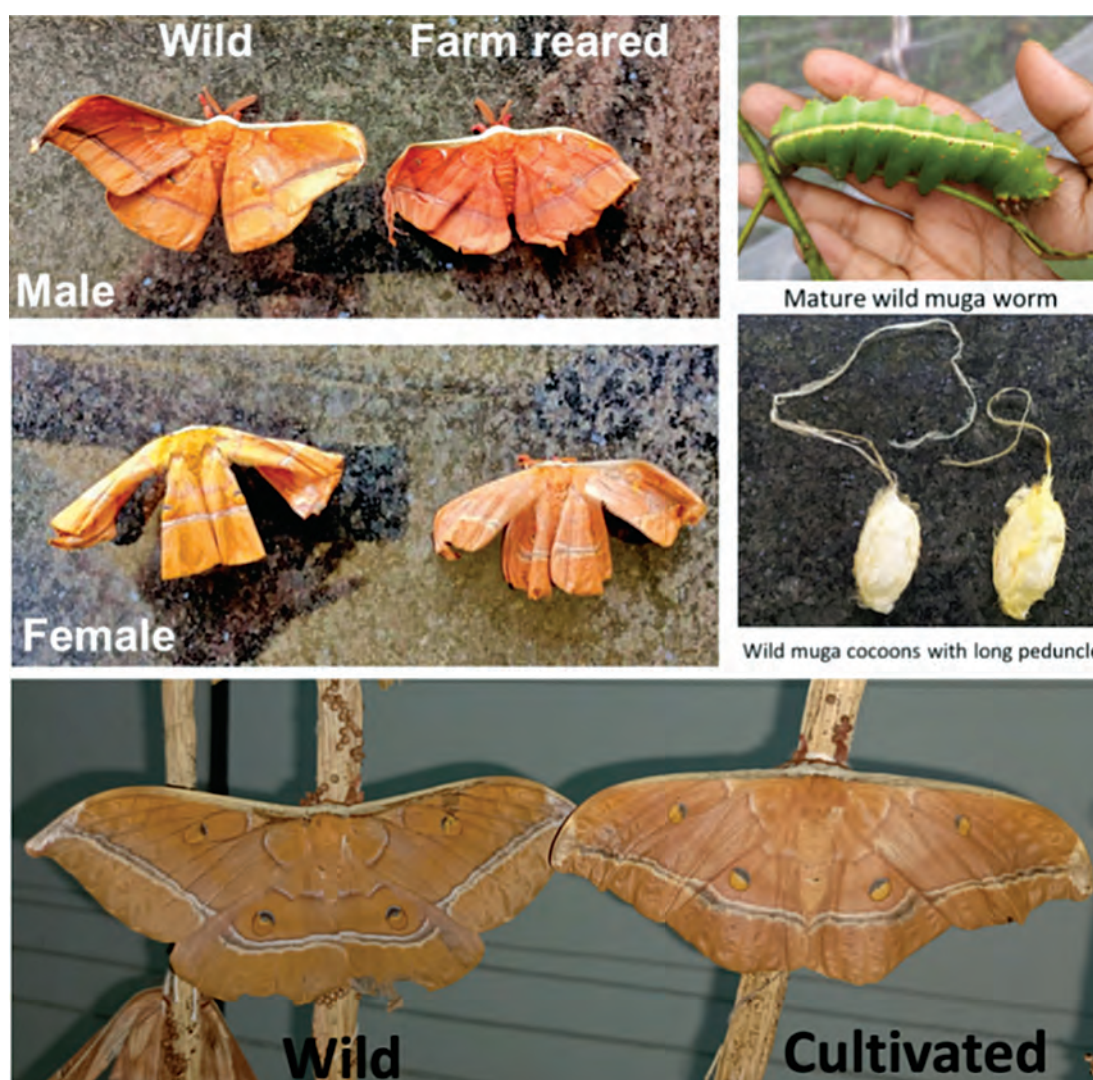


Figure 1: Wild muga samples in comparison with cultivated stock

Table 1: Genetic and genomic characteristics of wild and cultivated stocks of muga silkworm.

Characters	Wild	Cultivated
Pupal hibernation	Both winter and summer	No hibernation
Fecundity	250-300	150-200
Filament length	400-700	150-300
Peduncle	Present	Absent
Cocoon weight	6-9gms	4-7gms
Larval hairs	Prominently seen during 5th instar	Not so prominent

Wild

Sample	SNPs Het rate (%)	Indels Het rate (%)
AAWTF3	0.278	0.013
AAWTF4	0.196	0.008
AAWTF8	0.301	0.014
AAWTFM2	0.250	0.010
AAWTFM5	0.249	0.011
AAWTFM6	0.069	0.004
AAWTFM7	0.254	0.011
AAWTFM11	0.303	0.014
AAWTFM12	0.309	0.015

Cultivated

Sample	SNPs Het rate (%)	Indels Het rate (%)
AACIF1	0.029	0.002
AACIF4	0.033	0.001
AACIF6	0.018	0.001
AACIF7	0.002	0.000
AACIF9	0.015	0.001
AACIM10	0.042	0.002
AACIM15	0.041	0.002
AACIM9	0.039	0.002
AACIM18	0.032	0.002
AACIM19	0.055	0.003



Project Code: APR05007SI

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

Project Period : October, 2019 to September, 2022

Funding Agency : Central Silk Board, Bengaluru

Total Budget Allocation : 18.15 Lakhs

Total Expenditure : 8.84 Lakhs
(During the year)

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 rearing equipment
3. Development of new rearing method and ideal environment for eri chawki rearing.

Summary of the findings / achievements:

- In this year, Chawki leaves harvesting schedule, chawki leaves yield at different intervals in a year and number of DFLs that can be reared/ hectare of NBR-1 castor leaves have been standardized.
- Biochemical compositions of selected castor varieties have been estimated and standardized the range of leaf quality parameters required for eri chawki worms.
- Uses of disinfectants and disinfection schedules have been standardized.
- Eri chawki certification (before distribution of chawki worms) has been standardized.
- Low cost heating system for eri chawki rearing house for cooler region and winter season by using locally available material has been standardized.
- Several demonstrations and field testing of eri chawki rearing have been completed in the areas Viz., Jorhat, Dhemaji, Golaghat districts of Assam and Chungtia of Nagaland.
- The yield from chawki rearing was compared with the conventional method in farmers' field and found to be significantly higher.
- Designed a blueprint for the model eri chawki rearing house. Eri chawki rearing house 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.

Table 1: The yield of Chawki leaves at different intervals in a year and number of DFLs that can be reared/ hectare of NBR-1 castor leaves

Harvesting time	Castor chawki leaves yield (Kg/ha)	Number of DFLs reared /ha
1 st harvesting (90 days after sowing)	1125	15000
2 nd harvesting (60 days after 1 st harvesting)	1350	18000
3 rd harvesting (60 days after 2 nd harvesting)	1575	21000
4 th harvesting (60 days after 3 rd harvesting)	1125	15000
5 th harvesting: (60 days after 4 th harvesting)	900	12000
6 th harvesting: (60 days after 5 th harvesting)	675	9000
Total	6750	90000

Table 2: Plan for sowing of castor seeds and brushing/ hectare of eri chawki worms (6 plot module of 1667 plants/plot)

Sowing time (6 plot module) in 1 hectare	Brushing months						
	Batches	June	August	October	December	February	April
March 1 st	1 st batch	2500 DFLs	3000 DFLs	3500 DFLs	2500 DFLs	2000 DFLs	1500 DFLs
March 11 th	2 nd batch	2500 DFLs	3000 DFLs	3500 DFLs	2500 DFLs	2000 DFLs	1500 DFLs
March 21 st	3 rd batch	2500 DFLs	3000 DFLs	3500 DFLs	2500 DFLs	2000 DFLs	1500 DFLs
Total		7500	9000	10500	7500	6000	4500
	Brushing months						
	Batches	July	September	November	January	March	May
April 1 st	1 st batch	2500 DFLs	3000 DFLs	3500 DFLs	2500 DFLs	2000 DFLs	1500 DFLs
April 11 th	2 nd batch	2500 DFLs	3000 DFLs	3500 DFLs	2500 DFLs	2000 DFLs	1500 DFLs
April 21 st	3 rd batch	2500 DFLs	3000 DFLs	3500 DFLs	2500 DFLs	2000 DFLs	1500 DFLs
Total		7500	9000	10500	7500	6000	4500

Table 3: Biochemical composition of castor leaves:

Parameters	NBR-1	Kalpi-6	DCH-519	DCS-9	ICH-66
Moisture (%)	80.31±0.42	79.18±0.39	70.69±0.27	73.68±0.29	75.19±0.33
Moisture retention capacity (%)	82.65±0.37	71.83±0.62	66.32±0.34	70.56±0.24	71.92±0.31
Protein (%)	20.60±0.25	16.30±0.18	14.08±0.15	15.79±0.20	14.93±0.16
Total carbohydrates (%)	17.12±0.52	15.39±0.56	14.59±0.21	13.11±0.18	14.08±0.20
Total sugars (%)	8.62±0.30	8.12±0.25	6.44±0.16	5.85±0.20	7.51±0.25
Reducing Sugars (%)	1.23±0.05	1.09±0.02	0.93±0.11	1.03±0.07	1.06±0.04
Fiber content (%)	6.49±0.38	7.03±0.41	6.15±0.35	5.98±0.42	6.91±0.32
Free amino acids (%)	0.75±0.04	0.52±0.03	0.39±0.02	0.41±0.04	0.45±0.06
Total chlorophyll (mg/g)	2.85±0.16	1.78±0.08	1.55±0.10	1.46±0.17	1.64±0.12
Carotenoids (mg/g)	0.098±0.02	0.059±0.01	0.049±0.01	0.054±0.02	0.055±0.01
Ash (%)	5.89±0.40	5.21±0.26	4.31±0.22	4.12±0.31	5.08±0.23

Table 4: Disinfection schedule by using Asthra:

Day/Event	Activity	Details of Activity
On Completion of Eri Chawki Rearing	1	First disinfection of Eri CRC & appliances with 0.05% Asthra solution.
3 days Before Brushing	2	Cleaning & washing of CRC building Rearing Trays disinfection
2 days Before Brushing	3	Second disinfection of Eri CRC & appliances with 0.05% of Asthra solution
1 day Before Brushing	4	Dusting 5% Bleaching powder in slaked lime powder surrounding of Eri CRC Open the windows of CRC for ventilation and to free the gases accumulated

Table 5: Disinfection schedule by using bleaching powder and slaked lime:

Day/Event	Activity	Details of Activity
On Completion of Eri Chawki Rearing	1	First disinfection of Eri CRC & appliances with 2% Bleaching powder solution.
3 days Before Brushing	2	Cleaning & washing of CRC building Rearing Trays disinfection
2 days Before Brushing	3	Second disinfection of Eri CRC & appliances with with 2% Bleaching powder solution
1 day Before Brushing	4	Dusting 5% Bleaching powder in slaked lime powder surrounding of Eri CRC Open the windows of CRC for ventilation and to free the gases accumulated

Table 6: Eri chawkiworms certification before distribution

Name of the Eri CRC:		Address:	
Date of Brushing:		Hatching %:	
Source of dfls:		Lot No. :	
Breed/Ecorace:		No. of dfls:	
Stage of Larvae: 2 nd moult		No. of trays kept/100 dfls : 8	
Chawki Certification System		Norms	Observation
Assessment	Missing Larvae	< 2 %	✓
	Larval Uniformity [undersized larvae]	< 2 %	✓
	Growth of larvae (wt./100 larvae)	5.5-6.0 grams/100 worms	✓
Visual & Microscopic Examination	Grasserie	Free	✓
	Flacherie	Free	✓
	Muscardine	Free	✓
	Pebrine	Free	✓

Table 7: Comparison of rearing performance of C2 chawki worms in favorable season and winter season

Observations	Favorable season (Chawki worms)	Winter season (Chawki worms)	Winter season (Conventional)
5 th instar larval weight (gms)	9.40±0.20	8.64±0.35	7.82±0.22
Mature worms collection duration (days)	2.74±0.44	5.68±1.12	9.25±2.16
Single Cocoon weight (gm)	3.03±0.25	2.93±0.13	2.61±0.17
Single Pupal weight (gm)	2.73±0.31	2.68±0.09	2.47±0.14
Single Shell weight (gm)	0.38±0.02	0.25±0.03	0.19±0.05
Missing larvae (%)	1.30±0.45	6.82±0.90	23.85±2.56
Disease Incidence (%)	0.42±0.18	5.23±0.23	17.63±2.11
ERR (%)	98.28±0.31	87.95±0.57	58.52±2.33
Pupal yield (No.) / 100 DFLs	33,000	30,166	19,662
Shell yield (Kg) / 100 DFLs	12.10	7.54	3.73
Gross profit from the rearing (Rs.) / 100 DFLs	50,930	38,032	22,408



Fig 1: Low cost heating system (Using oil tin, charcoal, sand and iron pan)



Fig 2: Transportation of chawki worms from CMER&TI



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. 5.00 lakhs

Scientist Involved : Dr. Reeta Luikham, PI

: Dr. Aftab Ahmad Shabnam, CI

Objectives:

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

Summary of the findings / achievements:

- During this period 04 Ecoraces and C2 breed (Selfed F_5 generation upto F_7 generation) were carried out for attaining homogeneity.
- The twelve strains obtained from 04 ecorace and C2 breed were evaluated at F_7/F_7^{th} generation following the multiple trait evaluation index (E.I.) method of Mano *et al.* (1993).
- Based on the average cumulative index value of seven characters, it can be deduced that the four strains viz., Borduar (YP), Titabar (GBP), Kokrajhar (GBP) & Genung (YP) and C2 breed are the superior genotypes as these exhibited E. I. value of >50. Based on the data generated, parental selections were made for inclusion in diallel cross (fig 1).
- Intra-specific hybridization was done by selecting pureline parents of ecoraces & C2 breed to cross in 5x5 full diallel fashion to produce F_1 crossed seed. Recorded fecundity, morphologies of moths, eggs etc. Assessment of cocoon parameters like cocoon weight, shell weight, shell ratio also recorded.

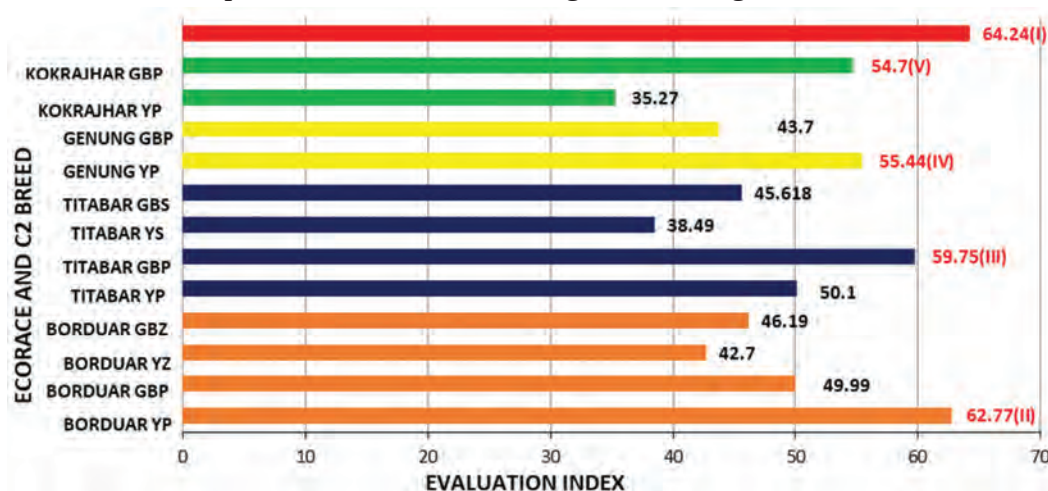


Fig 1: Avg. E.I has been calculated for 08 characters viz., Fecundity, Hatching (%), Larval wt (g), ERR (%), Cocoon wt. (g), Shell wt. (g), Shell Ratio (%), Cocoon yield (Nos.)/Dfl for 13 genotypes

Table: Mean value of 5x5 cross combination

Crosses	FECUNDITY	HAT%	L Wt	ERR%	C Wt	S Wt	SR%
C2 x C2	368.67	87.36	7.53	85	3.52	0.52	14.60
C2 xB YP	366.67	84.23	7.55	88	3.50	0.53	15.14
C2 X T GBP	350.67	92.97	7.31	84	3.28	0.45	13.71
C2 X G YP	347.22	94.33	7.49	76	3.38	0.43	12.72
C2 X K GBP	337.11	84.89	6.88	81	2.84	0.42	14.53
B YPX C2	353.67	93.20	7.50	78	3.32	0.48	14.45
B YP X B YP	365.20	89.39	7.58	91.96	3.50	0.49	14.00
B YP X T GBP	370.56	88.98	7.56	89	3.54	0.54	15.25
B YP X G YP	350.22	91.11	6.98	77	3.52	0.51	13.92
B YP X K GBP	334.78	84.94	7.24	81	3.21	0.41	12.77
T GBP X C2	354.00	87.34	7.41	84	3.20	0.44	13.75
T GBPX B YP	351.56	92.64	7.25	86	3.39	0.50	14.74
T GBP X T GBP	360.60	86.87	7.51	89.00	3.48	0.48	13.79
T GBP X G YP	346.67	80.85	7.16	83	3.26	0.43	13.19
T GBP X K GBP	337.00	88.24	6.90	83	3.20	0.40	12.50
G YPX C2	354.89	85.81	7.45	87	3.48	0.46	13.21
G YPX B YP	333.44	90.41	7.23	84	3.44	0.49	14.24
G YPX T GBP	369.89	90.14	7.48	86	3.57	0.52	15.40
G YPX G YP	361.80	88.14	7.41	87.78	3.34	0.46	13.77
G YPX K GBP	339.67	91.46	6.99	83	3.11	0.41	13.18
K GBP X C2	345.44	85.03	6.76	79	3.24	0.45	13.88
K GBP X B YP	344.44	82.09	7.17	79	3.10	0.40	12.90
K GBP X T GBP	331.67	83.78	7.32	74	3.21	0.41	12.77
K GBP X G YP	326.67	86.07	6.50	79	2.93	0.39	13.31
K GBP X K GBP	361.80	88.14	7.41	87.78	3.34	0.46	13.77
C2 breed	368.67	87.36	7.53	85	3.52	0.52	14.60
MEAN	348.71	87.89	7.22	82.1	3.29	0.45	13.87
CD at 5%	13.08	4.17	0.21	NS	0.11	0.02	0.635

- Inter-specific hybridization was done by utilizing pure wild eri *S. canningi* as male parent and crossed with two ecoraces (Borduar and Kokrajhar) out of 04 ecoraces and C2 breed during grainage activities to produce F1 crossed seed. Composite rearing and assessment of cocoon parameters like cocoon weight, shell weight, shell ratio were recorded.

Wild eri silkworm, *Samia canningi*: Selfed F1, F2 and F3 generation of Wild eri *Samia canningi* were completed.



Fig 2: Seed cocoon of selfed F3 *Samia canningi*



Project Code: ARP05015SI

Project Title: Development of chemical based control measures for management of pebrine disease in Muga silkworm, *Antheraea asamensis* Helfer (CSB funded)

Project Period	: January, 2021 to December, 2023
Funding Agency	: Central Silk Board, Bengaluru
Total Budget Allocation	: 19.92 Lakhs
Total Expenditure (During the year)	: 5.19 Lakhs
Scientist Involved	: Dr. Arun Kumar K.P. PI : Dr. G. Subrahmanyam, PI (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:

➤ ***Treatment of pebrine infected eggs***

Pebrine infected eggs were collected and divided on the basis of spore density (high and low spore density) and were treated with two chemicals (0.2% NaOCl and 2% Nirmool), then the hatched larvae were reared. Cocoons were collected and the emergence was observed. Maximum number of cocoons were obtained in treated and untreated low spore density category. Emerged mother moths were tested for pebrine disease. Both 0.2% NaOCl treatment and 2% Nirmool were able to decrease pebrine infection but significant decrease observed in the number of pebrine infected adult moth that emerged from treatment of 0.2% NaOCl low density category. Whereas, in high density category high mortality of larvae was observed. Finally, it was observed that 0.2% NaOCl treatment to eggs with low density spores infection can result in healthy growth of larvae. This proves the transovum vertical transmission of pebrine disease which can be treated with 0.2% NaOCl leading to decrease in seed wastage.

➤ ***Testing of different fungicides in vitro (Motility assay and Germination assay)***

A number of chemical agents were tested against *Nosema* spores *in vitro*. Motility assay was conducted by observing under digital microscope. Also, germination assay of the spores was performed using GKK Germination assay. Different concentrations of chemical agents Mancozeb 75%, Carbendazim 12% + Mancozeb 63%, Carbendazim 50%, Nirmool and Neem oil were tested upon, with 2% NaOCl as positive control.

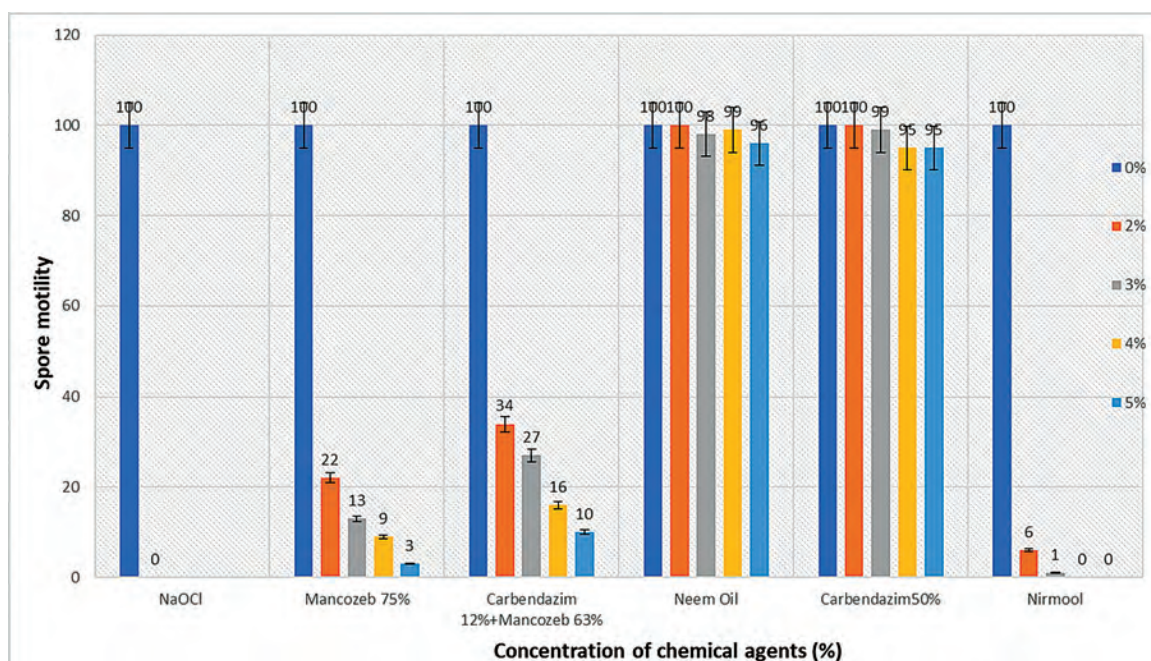


Figure 1: Spore motility assay showing decrease in number of motile spores in Mancozeb containing chemical agents and Nirmool

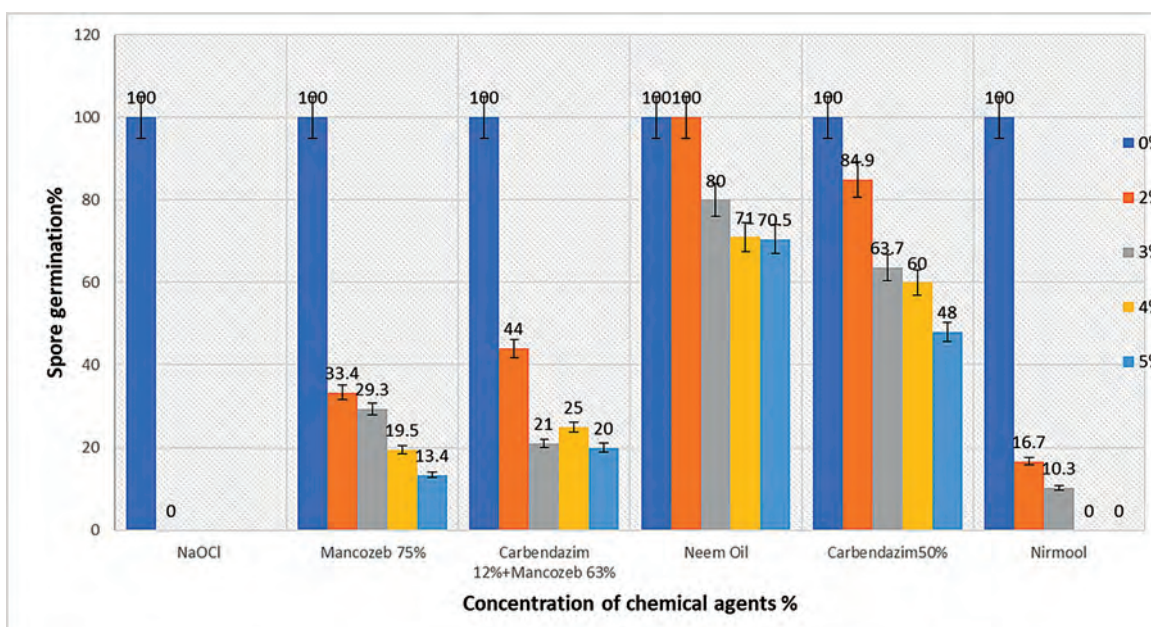


Figure 2: Spore germination assay showing decrease in germination of spores in Mancozeb containing chemical agents and Nirmool

It was observed that 5% Mancozeb reduced spore motility by 97% and spore germination was 13.4%. 3% Nirmool decreased spore motility by 99% and spore germination was 10.3%. Figure 1 and 2 show that among the tested chemical agents, Mancozeb containing chemical agents were able to reduce spore activity. But 3% Nirmool showed promising results by reducing the spore activity by 99%. Yet 2% NaOCl still has significant effect on *Nosema* spores. Additional chemical agents will be tested in future experiments for their effectiveness against pebrine disease.



Project Code: CFC 5017 MI

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	: 3.42 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**

- Isolated bacteria from different potential sources and screened for lipase and protease activity. Among them one bacterial isolate for lipase activity and five isolates were found positive for protease activity.
- The total protein content of the isolates was determined using Lowry's method.
- Effect of temperature on enzyme activity was done by recording the enzyme activity at different temperature using standard enzyme assay.
- The identification of bacteria was carried out by morphological physiological and molecular studies (16SrRNA sequencing) including Gram's staining, biochemical tests and 16SrRNA sequencing.

Non-enzymatic approach

- A novel cooking formulation has been developed that can achieve quick, efficient and uniform cocoon cooking with no compromise on the resultant raw silk quality.
- Comparative analysis of different cooking techniques on muga cocoons was done and the encouraging results were recorded.
- Cooking duration using new formulation was reduced from 15-20 minutes (as in the case of soda based cooking technique) to 3-4 minutes.

- 25-30% reduction in yarn breaks during reeling process attributed to uniform cocoon cooking, thereby improving the reelability of cocoons.
- The cooking liquor can be reused for 3-4 times which can further uphold the eco-friendly and economical aspects of cooking technique.
- The readability results and the ease of cooking technique indicate the potential and positive impact of the new formulation in muga reeling sector.



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 (During the year)	: 1.70 lakhs
Scientist Involved	: Dr. Manjunath R.N., PI : Dr. Mahesh D.S., CI : Dr. U Hazarika, 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:

- Upon maturing, the Muga larval dimensions were recorded to optimize the cell dimensions and construction of Honeycomb Mountage.
- Mountages in Honeycomb structure were fabricated from possible constructional material (Laminate, cardboard, tin foil, bamboo etc).
- The larvae of equal weight were selected and cocooning trials were conducted different mountages and the resultant cocoons were assessed for their parameters.
- Honeycomb mountages is found to be conducive and provide confined space to produce muga cocoons with uniform shape and size with further enhancement of 10-12% in reelability and raw silk recovery%.

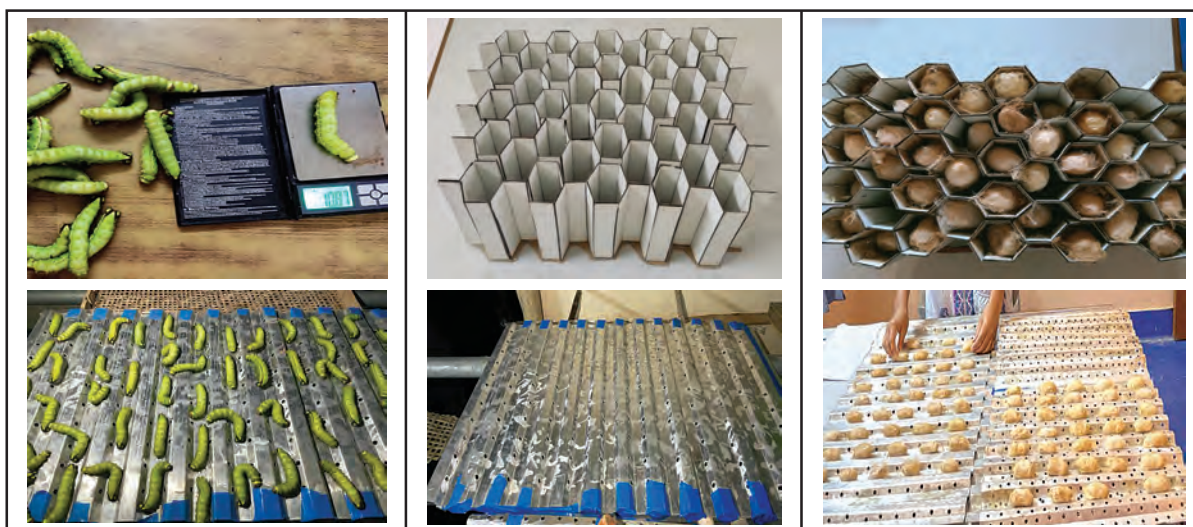


Fig1: Fabricating the concept of honeycomb mountage and their respective cocooning trials



Project Code: APS05020MI

Project Title: Commercial egg production technology for ericulture

Project Period : February, 2021 to January, 2024

Funding Agency : Central Silk Board, Bengaluru

Total Budget Allocation : 14.65 Lakhs

Total Expenditure : 0.21 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:

Project is initiated recently. The work on design and fabrication for standardization and selection of suitable egg laying device for commercial egg production is under progress. The expected outcome of this project are: production of more DFLs per unit area; significantly reduction of labour and time; preservation techniques for seeds; synchronization in hatching and further rearing performance; uniformity in rearing performance and less labour throughout the rearing and also during spinning stage; scaling up of production of eri DFLs. The new technology may be applied in developing egg production enterprise in Northeast and other eri growing regions of India.



खाद्य पौध विभाग HOST PLANT DIVISION



ON GOING 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 : Rs. 3.90 lakhs
 (During the year)
 Scientist Involved : Dr. Aftab A. Shabnam, CMER&TI, PI
 : Dr. Amit Kumar, CMER&TI, CI
 : 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 with 28 castor accessions [20 perennial and 03 annual castor accessions collected from North East region, 03 annual castor varieties (DCS-9, ICH-66 and DCH-519) collected from IIOR, Hyderabad, Kalpi-6 collected from UP and YTP-1 Collected from TNAU, Tamil Nadu].
- 1st crossing lot: 12 different reciprocal/cross combinations, F1 generation plants selfed & F2 seeds harvested, F2 generation in progress.
- 2nd crossing lot: 17 cross combinations were carried out and F1 seeds of 15 crosses harvested. 02 wide crosses (NBR-1 X NBR-P-Imphal and NBR-1 X SBR-P-Shillong) successfully carried out and F1 seeds harvested. F1 generation in progress.
- Mass selection lot: Selfed F2 seeds of potential perennial accessions were sown for mass selection.

Table-1: Castor accessions collected/acquired till March 2022

Accession No.	Type/Source	Accession No.	Type/Source
01	NBG-P. Leimakhong, Kangpokpi (Manipur)	15	Kalpi-6. (Perennial) REC Fatehpur (Uttar Pradesh)
02	NBR-P. L.Phaikot, Kangpokpi (Manipur)	16	DCS-9. Indian Institute of Oil Seed Research, Hyderabad (Telangana)

Accession No.	Type/Source	Accession No.	Type/Source
03	NBR-P. Pukhao Wakhong, Imphal (E) (Manipur)	17	ICH-66. Indian Institute of Oil Seed Research, Hyderabad (Telangana)
04	NBR-P. Upper Doigrung, Golaghat (Assam)	18	DCH-519. Indian Institute of Oil Seed Research, Hyderabad (Telangana)
05	NBR-P. Upper Golaghat (Assam)	19	NBR-1 (Annual). Germplasm Conservation Centre, Chenijan, Jorhat (Assam)
06	NBR-P. Ghotovi, Nuiland, Dimapur (Nagaland)	20	NBR-P. Kumbi, (Manipur)
07	NBR-P. Mokokchung (Nagaland)	21	YTP-1 (Perennial), Tamil Nadu Agriculture University, Yethapur Salem, (TN)
08	NBG-P. Jakhama village (Nagaland)	22	NBR-P. RSRS Campus, Imphal (Manipur)
09	NBR-P. Topatoli, Pachim Nagaon(Assam)	23	NBR-P. Jengraimukh Road, Majuli (Assam)
10	NBR-P. Topatoli, Pachim Nagaon(Assam)	24	SBR-P. Meghalaya
11	NBG-P. Topatoli, Pachim Nagaon (Assam)	25	NBR-P. Behind NESAC Guest House, Meghalaya
12	NBR-P. Topatoli, Pachim Nagaon (Assam)	26	NBR-P. Mokokchung, Nagaland
13	NBR-P. Umsohlang, (Meghalaya)	27	NBR-P. Lucknow, Uttar Pradesh
14	NBR-A. CMER&TI Quarter Campus, Jorhat (Assam)	28	NBG-P. Dhulijan, Tinsukia (Assam)

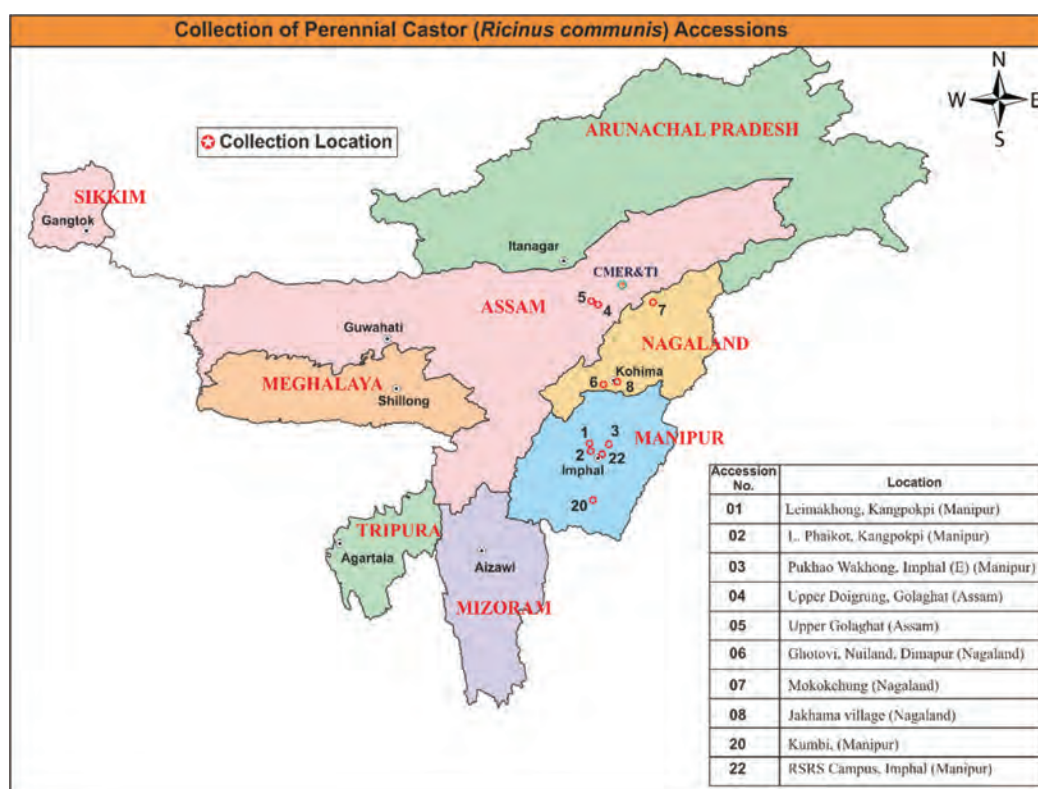


Figure: Coollection of castorgermplasm from North east India.



Figure 1: Selection of perennial Castor Plant used for crossing.



Figure2: Emasculation, Bagging and Crossing of Perennial Accessions at Institute's Farm.

Table-2: Variability in metric traits of 17 castor accessions:

S. No	Character	N	Min.	Max.	Mean	Variance	S.E	CV %
1	Plant height(m)	153	0.78	2.56	1.44	0.21	0.04	32.22
2	Internodal distance(cm)	153	9.09	20	12.55	7.97	0.23	22.50
3	Leaf area(sq.cm)	153	428.61	762.40	632.66	4979.11	5.70	11.15
4	Lobe length(cm)	153	15	36	22.22	18.57	0.35	19.39
5	Lobe breadth(cm)	153	8	22	13.24	11.53	0.27	25.64
6	Petiole diameter(mm)	153	5.33	23.61	14.18	28.28	0.43	37.50
7	Insertion of primary raceme(m)	153	0.57	1.57	0.98	0.05	0.02	23.42
8	Stem diameter(mm)	153	15.56	47.52	28.08	48.70	0.56	24.85
9	Length of primary raceme(cm)	153	16	42	28.02	20.11	0.36	16.01
10	No. of shoot per plant(No)	153	4	15	8.41	5.83	0.20	28.74
11	Total shoot length(m)	153	2.61	14.34	7.21	7.38	0.22	37.66
12	100 leaf weight(g)	153	1388.20	2951.60	1848.69	84277.83	23.47	15.70
13	No. of lobe(No)	153	7	11	9.45	1.10	0.08	11.12

14	Seed yield(g)	153	18.37	57.94	31.72	77.95	0.71	27.84
15	Leaf yield	153	0.63	1.92	1.05	0.07	0.02	24.51
16	Leaf petiole ratio	153	2.05	4.21	2.83	0.26	0.04	18.00
17	Leaf shoot ratio	153	0.29	0.69	0.43	0.00	0.00	13.55

Table-3: Variability in Morphological traits of 17 castor accessions

S.N	Characters	Frequency Distribution
1	Habit	Erect (64%), Semi-erect (18%), Bushy (12%) Spreading (06%).
2	Growth Nature	Erect (70%), Spreading (18%), Semi-erect (12%)
3	Stem colour	Green (12%), Red (35%), Mahogany (18%), Pinkish red (35%)
4	Lobe shape	Incised (100%)
5	Branching Nature	Divergent (59%), Convergent (41%)
6	Bloom	Non-bloom (70%), Triple bloom (30%).
7	Leaf Shape	Peltate (100%)
8	Leaf colour	Light green (06%), Medium green (35%), Dark green (59%)
9	Leaf apex	Mucronate (59%), Acuminate (41%)
10	Leaf glossiness	Slightly glossy (41%), Non glossy (59%)
11	Leaf Margin	Serrate (94%), Serrulate (06%)
12	Leaf Surface	Smooth (35%), Slightly rough (47%), Rough (18%)
13	Flowering Time	Precocious (18%), Medium (64%), Late (18%).
14	Mature shoot colour	Red (88%), Green (12%)
15	Anthocyanin Pigmentation	Present (35%), Absent (65%)
16	Pigmentation of primary veins	Greenish (76%), Reddish (24%)
17	Wax on adaxial blade surface	Absent (76%), Present (24%).
18	Coloration of adaxial blade surface	Medium green (41%), Dark green (63%), Light green (06%)
19	Staminate flowers on the Raceme	Present (100%)
20	Location of staminate flowers	Predominantly on the lower part of the Raceme (75%), Interspersed with the pistillate flowers (25%)
21	Stigma coloration	Reddish (100%)
22	Density of Raceme	Intermediate (50%), Sparse (50%)

S.N	Characters	Frequency Distribution
23	Raceme shape	Conical (25%), Cylindrical (50%), Globose (25%)
24	Fruit wax	Absent (100%)
25	Fruit coloration	Medium green (75%), Light green (25%)
26	Fruit Dehiscence	Non dehiscent (75%), Semi dehiscent (25%)
27	Presence of secondary coloration on seed	Present (100%)
28	Presence of Prickles on the fruits	Present (100%)
29	Density of the Prickles on the fruits	High (29%), Medium (65%), Low (06%)
30	Coloration of the fruit prickles	Medium green (71%), Pinkish green (06%), Dark green (06%), Light green (17%)
31	Sex Expression	Monoecious (100%)
32	Phyllotaxy	Distichous (29%), Pentastichous (18%), Tristichous (53%)
33	Leaf texture	Membranous (47%), Coriaceous (63%)

Table-4: Variability in seed metric traits of 28 castor accessions:

S. No	Character	No of Observations	Min.	Max.	Mean	Variance	S.E	CV%
1	Seed Length (mm)	840	7.470	16.920	10.602	2.60	0.056	15.207
2	Seed Breadth (mm)	840	4.600	10.720	6.798	1.451	0.042	17.717
3	Elongation Index	840	1.283	2.035	1.571	0.015	0.004	7.780
4	Caruncle Length (mm)	140	0.930	3.560	1.957	0.282	0.045	27.114
5	Caruncle Breadth (mm)	140	0.290	2.240	1.034	0.132	0.031	35.181
6	100 seed weight (g)	84	11.076	61.723	26.403	98.792	1.084	37.646



Project Code: AIP-05013-SI**Project Title: Impact of elevated CO₂ and temperature in muga Silkworm and its primary host plants**

Project Period	: March, 2020 to February, 2023
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. Amit Kumar, CMER&TI, PI : Dr. Aftab. A. Shabnam, CMER&TI, CI : Dr. G. Subramanyam, CMER&TI, CI(up to 26.07.2021) : Dr. D. K. Jigyasu, CMER&TI, CI

Objectives

1. To assess the influence of elevated CO₂ and temperature on growth and yield attributes of primary host plant (Som).
2. To assess the impact of elevated CO₂ and temperature on muga seed crop production, cocoon characteristics and fecundity.
3. To design strategies for adoption in muga silk worm rearing under the changing environmental scenario in Assam.

Summary of the findings/achievements:

- Three years old Som plant plots selected for the experiment were maintained as per recommended package of practices.
- The long-term (1981-2018) meteorological data of the different districts of Assam has been collected and processed for different muga rearing seasons.
- The inferences of the data have been documented in a book entitled “Seri-climatic Manual of Muga Growing Districts of Assam”. This book is submitted to CMER&TI for publication.
- Initial analysis of biochemical parameters of leaf and soil has been completed.
- Statistical data of biochemical parameters show that there is no significant difference between sets of plants at initial level.

Biochemical parameters of Som leaf: Initial analysis of Som plant leaves samples were carried out to check the nutrient status of plants and will be compared with the biochemical analysis after the six months treatment.

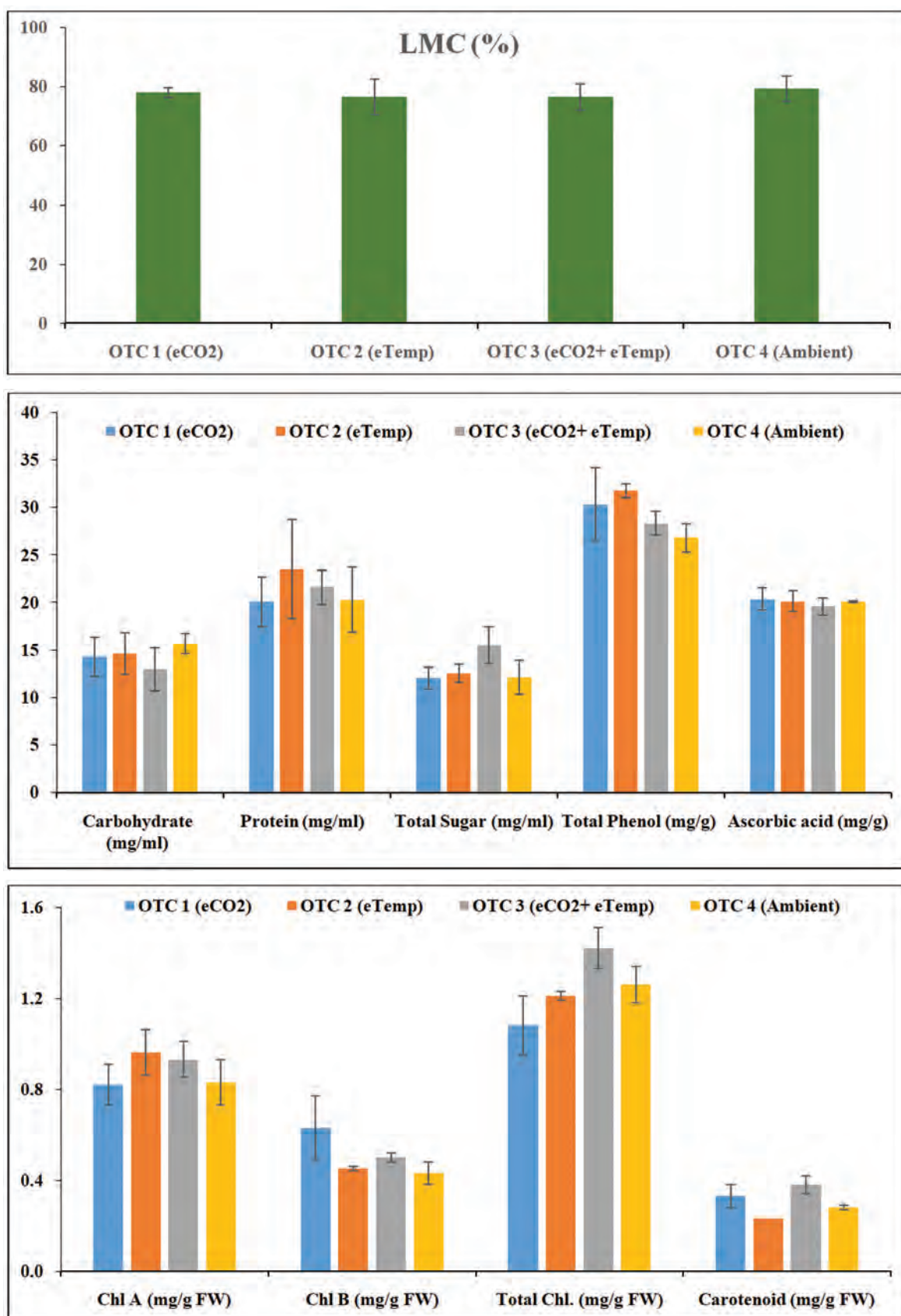


Figure: Initial Biochemical parameters of selected *Persea bombycina*, Som leaf



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 3.42348 lakh
Scientist Involved	: Kh. Subadas Singh, CMER&TI, PI : D K Jigyasu, CMER&TI, CI : S. A. S. Rahman, RSRS Boko, Co-PI : 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 :

Muga silkworm rearing on four different food plants viz., Som (*Persea bombycina*), Soalu (*Litsea monopetala*), Dighloti (*Litsea salicifolia*) and Mejankori (*Litsea cubeba*) both solo and combinations and grainage performance during Kotia (October-November, 2021), Jarua (December, 2021–January, 2022) and Chatua (March-April, 2022) was completed whereas Jethua (May-June), Aherua (June-July) and Bodhia (Aug-Sept.) crops were not completed due to Covid-19 restrictions.

- Soalu (*Litsea monopetala*) performs better in terms of fecundity in Kotia (Oct-Nov., 2021).
- However, in case of Jarua crop (Dec, 2021-Jan 2022), Som (*Persea bombycina*) host plant and its combination showed overall better results in respect to fecundity and ERR (%) and shell weight (g).
- Higher shell weight (g) was obtained from the silkworm reared on Som plant.
- Shorter larval period (day) was obtained from the silkworm reared on Som plant.
- Combination of Som (SM) + Soalu (SL) (vice versa), followed by combination with Dighloti performed better.
- Mejankori showed longest larval period (day) as compared to other food plants.

Table-1: Rearing and grainage performance during Kotia (Oct-Nov, 2021) commercial crop (n=01 dfl per treatment).

Name of host plant	Larval wt. (g)	Cocoon wt. (g)	Shell wt. (g)	Shell Ratio (%)	Pupae wt. (g)	ERR (%)	Fecundity (no.)	Hatching (%)
SOM	13.83±2.9	6.41±1.5	0.52±0.1	8.34±1.6	5.89±1.5	56±0.7	155±16.7	60.3±4.9
SOALU	14.24±1.0	6.80±1.3	0.61±0.1	10.03±1.8	6.18±1.3	53±0.7	170±7.7	58.8±8.1
DIGHLOTI	11.25±1.1	5.72±1.1	0.38±0.1	7.92±1.4	5.17±0.9	40±0.7	122±20.1	53.8±3.9
MEJANKARI	10.18±1.9	4.77±0.5	0.38±0.0	7.07±1.2	5.08±0.8	37±0.7	117±17.3	52.2±9.8
SM + SL	11.73±2.4	5.79±1.2	0.43±0.1	8.14±0.7	5.27±1.1	49±0.7	119±27.4	45.9±8.6
SM+DG	7.88±2.5	4.92±0.7	0.41±0.1	8.02±0.6	4.51±0.6	33±0.7	99±21.9	42.1±7.3
SM + MJ	7.92±1.5	5.17±0.8	0.36±0.1	6.96±1.0	4.81±0.7	28±0.7	67±38.2	42.3±9.9
SL+SM	10.67±2.5	5.27±0.9	0.44±0.1	8.28±0.8	4.93±0.8	50±0.71	121±21.3	57.0±9.4
SL+DG	6.73±2.0	5.30±0.6	0.43±0.1	7.98±1.4	4.87±0.5	37±0.7	87±43.9	35.8±9.1
SL+MJ	8.09±2.2	4.54±0.4	0.38±0.1	6.78±0.9	4.16±0.4	24±0.7	83±18.2	36.1±6.9
DG+SM	10.82±3.2	4.99±0.6	0.33±0.1	6.56±0.6	4.66±0.6	34±0.7	65±33.0	35.7±5.6
DG+SL	8.27±1.4	5.53±0.6	0.41±0.1	6.90±0.8	4.89±0.9	24±0.7	57±28.5	32.9±5.4
DG+MJ	8.17±2.0	5.20±0.8	0.38±0.1	7.17±1.1	4.83±0.7	23±0.7	61±18.8	43.1±9.9
MJ+SM	9.31±2.6	5.43±0.9	0.38±0.1	6.45±1.1	4.75±0.7	49±0.7	68±27.9	39.8±8.7
MJ+SL	7.71±1.7	5.21±0.9	0.39±0.1	6.57±1.4	4.68±0.8	45±0.7	69±41.7	42.3±9.9
MJ+DG	8.11±2.1	5.12±0.8	0.38±0.1	6.45±0.5	4.64±0.9	22±0.7	67±27.3	37.6±8.4
CD at 5 %	0.91	0.43	0.04	0.98	0.43	1.36	23.09	7.17

Table-2: Rearing and grainage performance during Jarua (Dec, 2021-Jan, 2022) crop (n=01 dfl per treatment).

Name of host plant	Larval wt. (g)	Cocoon wt. (g)	Shell wt. (g)	Shell Ratio (%)	Pupae wt. (g)	ERR (%)	Fecundity (no.)	Hatching (%)
SOM	10.02	4.39	0.34	7.88	4.05	46	191	55
SOALU	9.11	4.02	0.29	7.72	3.73	38	134	51
DIGHLOTI	7.41	3.30	0.27	7.45	3.03	30	126	50
MEJANKARI	7.18	3.23	0.25	6.65	2.98	26	115	46
SM + SL	8.74	3.77	0.28	7.35	3.49	48	117	46
SM+DG	7.23	3.31	0.26	7.35	3.05	46	98	42
SM + MJ	6.43	3.22	0.24	6.12	2.65	26	65	42
SL+SM	8.99	3.96	0.29	7.45	3.69	50	123	49
SL+DG	5.35	3.05	0.23	7.25	2.82	23	92	43
SL+MJ	6.89	3.35	0.21	6.19	2.65	22	81	40

Name of host plant	Larval wt. (g)	Cocoon wt. (g)	Shell wt. (g)	Shell Ratio (%)	Pupae wt. (g)	ERR (%)	Fecundity (no.)	Hatching (%)
DG+SM	8.09	3.54	0.26	6.12	3.27	47	62	42
DG+SL	7.92	3.79	0.26	6.42	3.54	27	59	38
DG+MJ	7.12	3.19	0.21	6.57	2.75	20	65	36
MJ+SM	7.96	3.38	0.24	5.92	2.93	41	65	36
MJ+SL	6.76	3.45	0.23	5.86	2.65	40	58	36
MJ+DG	6.64	3.38	0.22	5.32	2.56	21	62	33
CD at 5 %	0.51	0.37	0.03	NS	0.35	7.62	21.7	6.9

Table-3: Rearing and grainage performance during Chatua (March-April, 2022) crop (n=01 dfl per treatment).

Name of host plant	Larval wt. (g)	Cocoon wt. (g)	Shell wt. (g)	Shell Ratio (%)	ERR (%)	Fecundity (no.)
SOM	10.29	5.81	0.43	7.92	54	156
SOALU	10.75	5.98	0.40	7.82	49	214
DIGHLOTI	8.46	5.22	0.38	7.77	41	141
MEJANKARI	8.30	4.23	0.37	7.32	34	127
SM + SL	9.61	5.66	0.41	7.63	42	144
SM+DG	7.92	5.11	0.39	7.24	34	120
SM + MJ	7.47	4.72	0.37	7.41	31	107
SL+SM	9.15	5.38	0.41	7.66	49	137
SL+DG	6.64	5.22	0.35	7.50	24	127
SL+MJ	7.41	4.36	0.33	7.07	23	98
DG+SM	8.19	5.46	0.40	6.71	42	110
DG+SL	8.58	5.57	0.38	7.10	25	124
DG+MJ	7.48	4.30	0.32	6.82	24	92
MJ+SM	8.00	5.37	0.30	6.38	40	82
MJ+SL	8.23	5.28	0.31	6.25	25	106
MJ+DG	7.32	4.30	0.31	6.47	24	72
CD at 5 %	0.55	0.34	N/A	0.59	8.6	27.3

Table-4: Rearing performance during Jarua (Dec., 2021-Jan., 2022) crop at RSRS Boko (n=04 dfl per treatment).

Name of host plant	Larval Period	No. of Mature Worms Collected	Cocoon/dfl	ERR %	Cocoon wt.(g)		Shell wt.(g)		Disease record			
					M	F	M	F	Flacherie	Pebrine	Other	Total
Som	21	212	52	49.4	4.01	6.96	0.47	0.57	27	Nil	190	217
SM + SL	22	210	51	49	4.2	7.22	0.46	0.6	28	Nil	191	219
SM + DG	23	175	40	40.8	3.8	6.2	0.32	0.48	28	Nil	226	254
Soalu	22	215	52	50.1	4.5	7.5	0.41	0.62	29	Nil	185	214
SL + SM	21	212	51	49.4	4.2	7.2	0.38	0.61	27	Nil	190	217
SL + DG	23	170	38	39.6	3.9	6.5	0.33	0.5	26	Nil	233	259
Dighloti	24	168	37	39.2	3.6	6.4	0.31	0.51	15	Nil	246	261
DG + SM	22	225	54	52.4	4.2	7.2	0.42	0.58	15	Nil	159	174
DG + SL	22	218	53	50.8	4.4	7.5	0.43	0.63	16	Nil	195	211



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 January 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.

Table-1: Distribution of improved perennial host plants (2021-22).

S.No.	Area	No of Beneficiary	No. of Seedlings supplied	Host plant	Survival as on May 2022
1	Kamrup District	21	4000	Kesseru (HF-008 & HF-005)	79%
2	Jorhat	6	1500	Kesseru (HF-008 & HF-005)	82%
3	Nagaland	8	200	Borpat	92%
4	Sivasagar	6	3000	Som (S3 & S6)	88%
5	Sivasagar	39	4000	Kesseru (HF-008 & HF-005)	85%
6	Jorhat	3	500	Borpat	90%
7	Lakhimpur	70	3500	Borpat	89%
8	Lakhimpur	70	3500	Dighloti	85%
	Total	83	20,200	-	86%

Table-2: Results of Integrated Practice of ITK and Modern Technology for Muga Silkworm Seed production showing Z-test of Average Fecundity under ToT and Normal practice.

Location	Season	Nos. of farmers	Practices	N	Mean	Z	P	Z- Critical two-tail
Lakhimpur	Sep-2021	6	ToT	50	149.0	9.90	0.0	1.959**
			Normal	50	129.2			
Dibrugarh	-do-	5	ToT	50	147.9	9.77	0.0	1.959**
			Normal	50	129.3			
Sivsagar	-do-	1	ToT	50	153.0	16.5	0.0	1.959**
			Normal	50	137.0			
Dhemaji	Nov. 2021	6	ToT	50	156.2	10.6	0.0	1.959**
			Normal	50	145.3			
Goalpara	Jan -2022	5	ToT	50	152.1	33.0	0.0	1.959**
			Normal	50	133.2			
Kamrup	-do-	5	ToT	50	154.0	32.0	0.0	1.959**
			Normal	50	134.8			
Lakhimpur	Jan 2022	7	ToT	50	154.8	17.4	0.0	1.959**
			Normal	50	135.4			

** Significant at 1% level

Table-3: Results of Integrated Practice of ITK and Modern Technology for Higher Muga cocoon yield showing Z-test of cocoon yield and ERR under ToT and recommended practice.

Crop season	Parameters	Variables	N	Mean	t	df	p-Value
Nov-Dec 2021	Cocoon yield/df ERR	ToT	6	68.0	4.95	18.0	0.0001**
		Recommended Practice	6	56.7			
		ToT	6	59.9	4.97	18.0	0.0001**
		Recommended Practice	6	49.9			
Feb-Mar 2022	Cocoon yield/df ERR	ToT	12	55.0	7.31	18.0	0.001**
		Recommended Practice	12	47.0			
		ToT	12	47.0	7.31	18.0	0.001**
		Recommended Practice	12	40.4			

** Significant at 1% level

Figure 1: Distribution and popularization of muga and eri host plant to the beneficiaries under ToT.



जैव-प्रौद्योगिकी विभाग BIOTECHNOLOGY



Project Code: AIT05011EF**Project Title: Molecular Investigation into the Lignocellulolytic System of a Few Wild Silkmoth in North-East India.****Project Period** : September, 2019 to September, 2022

Funding Agency : DBT, New Delhi

Total Budget Allocation : 46.32 Lakhs

Total Expenditure : 6.52 Lakhs

(During the year)

Scientist Involved : Dr. Arun Kumar K.P., CMER&TI, PI

: Dr. Rajal Debnath, CI

: Dr. Dip. K. Gogoi, CI

Objectives:

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

Summary of the findings/achievements:***Profiling of gut metagenome of Antheraea assamensis Helfer***

For gut metagenome extraction and community profiling, instar stage insects were collected in DMSO and brought to laboratory. Guts were dissected aseptically and only the intestinal part is homogenized. High quality DNA was prepared and 19 nos. of 16S V3-V4 sequencing was done by NGS, Illumina MiSeq Platform. Preliminary analysis of the sequences observed that average nos. of sequences per sample were 165092 - 187467, average sequence length was 243 - 250, GC content of the sequences was 54% – 59%. After filtering, denoising, removing PCR artifacts/chimeras and 16S genes amplified from feed plant chloroplast, mitochondria, a total of 1363 Amplicon Sequence Variant (ASV) were detected across all the 19 samples. Microbiome characterization at family level revealed the abundance of *Beijerinckiaceae* family in muga gut and *Rhizobiaceae* family in eri gut (Figure 1A). Abundance (>5%) of *Beijerinckiaceae* family is irrespective of the host plants i.e., Som, Soalu and Dighloti in which muga silk worm was reared. However, genus level microbial characterization unveils substantially distinct abundance in Eri gut rather than in muga gut (Figure 1B). *Methylobacterium-Methylorubrum*, *Tyzzereella*, *Sphingomonas* are in more abundance (>30%) in muga gut whereas *Ochrobactrum*, *Pseudomonas*, *Aureimonas*, *Sphingomonas*, *Methylobacterium-Methylorubrum* are in abundance (>10%) in eri gut.



Figure 1: (A) Characterization of microbiome at the Family level classification. (B) Characterization of microbiome at the Genus level classification.

Presence of Wolbachia in muga gut is evident from the analysis. Wolbachia endosymbiont are extremely common bacteria that occur naturally in 50% of insect species. These bacteria compete against viral, bacterial and protozoan parasites. Moreover, they are safe for humans and the environment. A total of 402 sequences of Wolbachia were detected in three samples Aas30II, Aas38III, Aas39III (Figure 2A). All three samples were collected from *Antheraea assamensis* from II or III instar during the month of June (Summer). Closest BLASTn matches (Figure 2B) of the muga Wolbachia sequences (440 bp) against NCBI – nr database.

A

	Kingdom	Phylum	Class	Order	Family	Genus	Species
ASV264	Bacteria	Proteobacteria	Alphaproteobacteria	Rickettsiales	Anaplasmataceae	Wolbachia	NA
ASV322	Bacteria	Proteobacteria	Alphaproteobacteria	Rickettsiales	Anaplasmataceae	Wolbachia	NA
ASV324	Bacteria	Proteobacteria	Alphaproteobacteria	Rickettsiales	Anaplasmataceae	Wolbachia	NA
ASV372	Bacteria	Proteobacteria	Alphaproteobacteria	Rickettsiales	Anaplasmataceae	Wolbachia	NA
ASV420	Bacteria	Proteobacteria	Alphaproteobacteria	Rickettsiales	Anaplasmataceae	Wolbachia	NA

B

Wolbachia endosymbiont of	Wolbachia endosymbiont of	Wolbachia endosymbiont of	Wolbachia endosymbiont of	Wolbachia endosymbiont of	Wolbachia endosymbiont of	Wolbachia endosymbiont of	Wolbachia endosymbiont of	Wolbachia endosymbiont of	Wolbachia endosymbiont of
✓ Litomosoides sigmodontis strain wLsig chromosome, complete genome	✓ Litomosoides sigmodontis strain wLsig chromosome, complete genome	✓ Litomosoides sigmodontis strain wLsig chromosome, complete genome	✓ Litomosoides sigmodontis strain wLsig chromosome, complete genome	✓ Litomosoides sigmodontis strain wLsig chromosome, complete genome	✓ Litomosoides sigmodontis strain wLsig chromosome, complete genome	✓ Litomosoides sigmodontis strain wLsig chromosome, complete genome	✓ Litomosoides sigmodontis strain wLsig chromosome, complete genome	✓ Litomosoides sigmodontis strain wLsig chromosome, complete genome	✓ Litomosoides sigmodontis strain wLsig chromosome, complete genome
Wolbachia endosymbiont of <i>Tunga penetrans</i> clone 66 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Tunga penetrans</i> clone 66 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Tunga penetrans</i> clone 66 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Tunga penetrans</i> clone 66 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Tunga penetrans</i> clone 66 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Tunga penetrans</i> clone 66 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Tunga penetrans</i> clone 66 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Tunga penetrans</i> clone 66 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Tunga penetrans</i> clone 66 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Tunga penetrans</i> clone 66 16S ribosomal RNA gene, partial sequence
Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi349 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi349 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi349 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi349 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi349 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi349 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi349 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi349 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi349 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi349 16S ribosomal RNA gene, partial sequence
Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi813 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi813 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi813 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi813 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi813 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi813 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi813 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi813 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi813 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi813 16S ribosomal RNA gene, partial sequence
Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi801 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi801 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi801 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi801 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi801 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi801 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi801 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi801 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi801 16S ribosomal RNA gene, partial sequence	Wolbachia endosymbiont of <i>Madathamugadia hiepei</i> strain wMhi801 16S ribosomal RNA gene, partial sequence
Wolbachia endosymbiont of <i>Litomosoides sigmodontis</i> partial 16S rRNA gene, specimen voucher MIB.ZPL.01164	Wolbachia endosymbiont of <i>Litomosoides sigmodontis</i> partial 16S rRNA gene, specimen voucher MIB.ZPL.01164	Wolbachia endosymbiont of <i>Litomosoides sigmodontis</i> partial 16S rRNA gene, specimen voucher MIB.ZPL.01164	Wolbachia endosymbiont of <i>Litomosoides sigmodontis</i> partial 16S rRNA gene, specimen voucher MIB.ZPL.01164	Wolbachia endosymbiont of <i>Litomosoides sigmodontis</i> partial 16S rRNA gene, specimen voucher MIB.ZPL.01164	Wolbachia endosymbiont of <i>Litomosoides sigmodontis</i> partial 16S rRNA gene, specimen voucher MIB.ZPL.01164	Wolbachia endosymbiont of <i>Litomosoides sigmodontis</i> partial 16S rRNA gene, specimen voucher MIB.ZPL.01164	Wolbachia endosymbiont of <i>Litomosoides sigmodontis</i> partial 16S rRNA gene, specimen voucher MIB.ZPL.01164	Wolbachia endosymbiont of <i>Litomosoides sigmodontis</i> partial 16S rRNA gene, specimen voucher MIB.ZPL.01164	Wolbachia endosymbiont of <i>Litomosoides sigmodontis</i> partial 16S rRNA gene, specimen voucher MIB.ZPL.01164

Figure 2: Evidence of Wolbachia endosymbiont in Muga gut.

Impact of host plant range is inferred from the PCoA (ordination plot) analysis. The analysis depicts genetic relatedness of host plant species affecting gut microbial community structures. The microbial community cluster shows distinct separation from som fed worms (genus *Persea*) and Soalu and Dighloti (genus *Litsea*) as well from muga gut and eri gut (Figure 3).

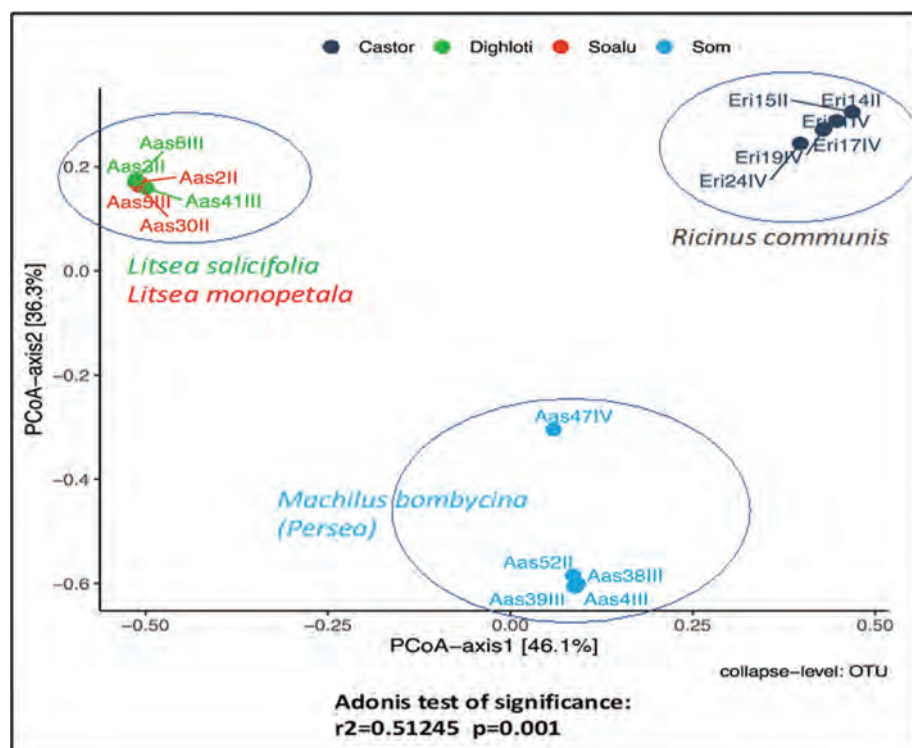


Figure 3: Genetic relatedness between host plant species (phylogeny) structures and insect microbiota.

Determination of cellulase enzyme activity

Cellulase activity was screened using CMC as a substrate which are degraded by microbes to produce endoglucanase. These on staining with Congo red give a positive result. Hence to evaluate the cellulose hydrolysis area CMC-Congo red selective media with CMC 5% is utilized and later stained with 0.5% Congo red solution and NaCl. Out of all the bacterial strains, the strains obtained from Muga gut samples of Mendipathar, Meghalaya showed highest cellulase activity. Among them, the strains, MS24 and MS223 showed better cellulase hydrolysis in comparison to the other positive strains. However, Quantitative analysis of endo-cellulase production (Figure 4) by the potential isolates show strains MB417 and MB420 as better cellulase enzyme producing microbes.

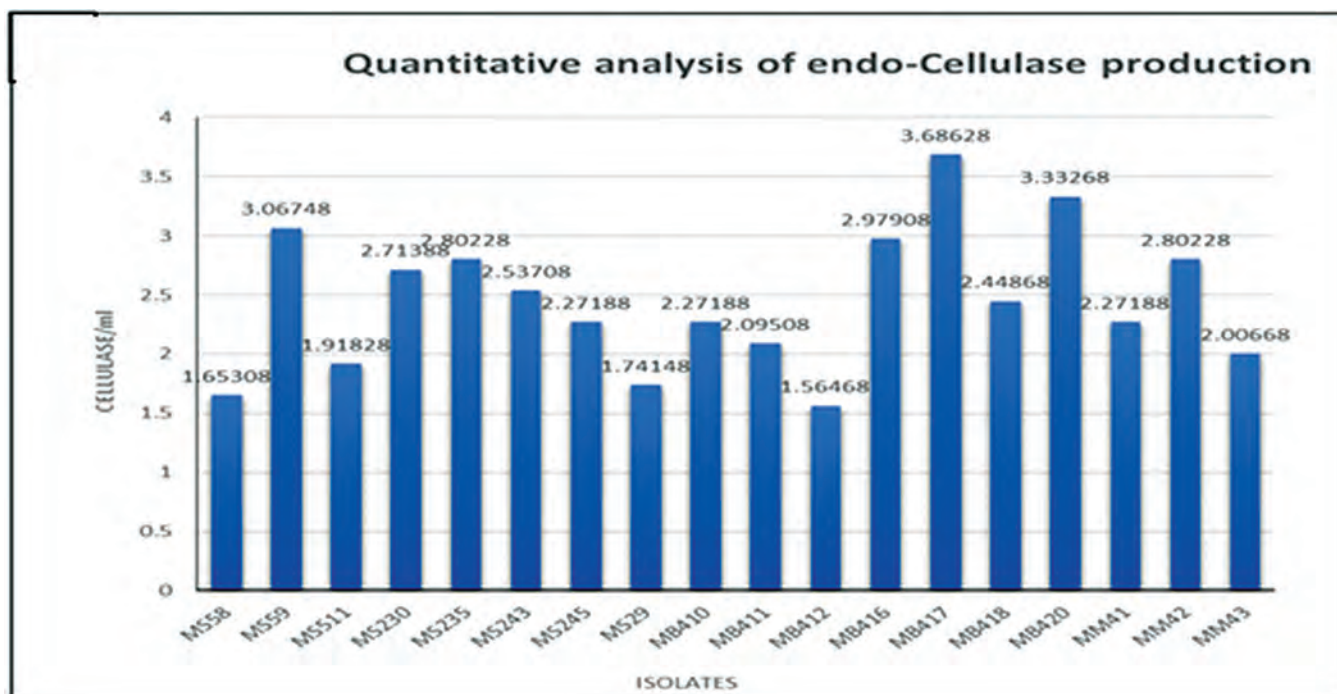


Figure 4: Quantitative analysis of endo-cellulase enzyme produced by potential bacterial isolates.



Project Code: AIT05016MI

Project Title: Integrating genomic and transcriptomics resources for functional insight into the biology of muga silkworm *Antheraea assamensis*.

Project Period	:01-01-2021 to 31-12-2022
Funding Agency	: Central Silk Board, Bangalore
Total Budget Allocation	: 69.67 lakh (44.60 CMER&TI + 25.07 SBRL)
Total Expenditure (During the year)	: Rs. 15.78 Lakh (CMER&TI)
Scientist Involved	: Dr. Arun Kumar K.P, CMER&TI, PI : Dr. Rajal Debnath, CI

Objectives:

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

Summary of the achievements:

- A detailed analysis of muga silkworm genome and transcriptomes was performed to assemble and annotate the raw sequences and to identify genes linked to silk traits and immune response so that such information can be used for screening muga populations with better immunity, and high silk yield and survival. Silk genes like sericins and seroins are yet to be characterized in muga silkworm. Also, not much is known regarding the immune response genes. These questions can be answered by utilizing the fairly good whole genome and transcriptome sequence data that has been generated for muga silkworm. Here we report the summarized report of the work done during the year.

Design and development of web accessible sequence database

- A web-based sequence database “*Vanya Silkbases*¹” is being developed to host the genome and transcriptome sequences of *Antheraea assamensis* online for public use with accessibility restrictions. Along with *A. assamensis* genome and transcriptome, genomes of *Antheraea mylitta*, *Antheraea pernyi*, *Samia ricini* and *Antheraea yamamai* is also hosted on the database. This database can be used to BLAST nucleotide and protein sequences against the sequences of the above-mentioned species. The database also has feature for viewing the gene expression in different tissues in *A. assamensis* transcriptome.

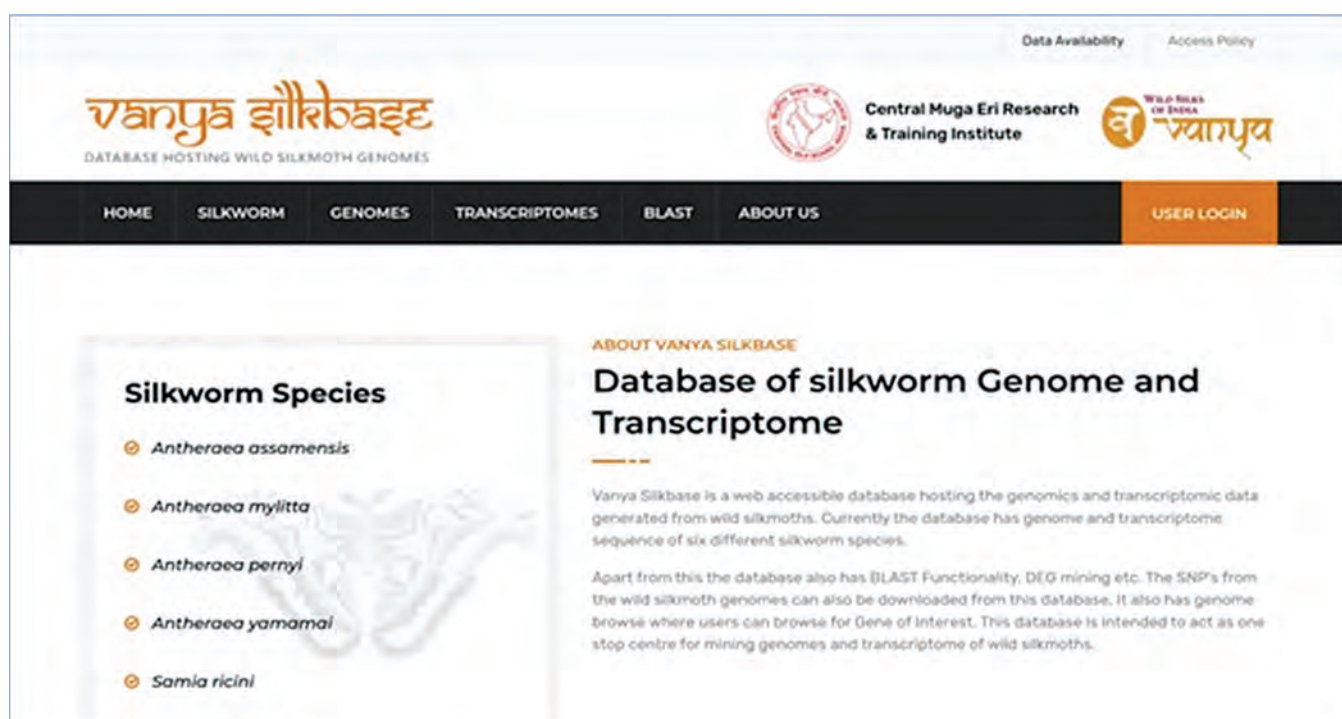


Figure 1: Screenshot from the Homepage of Vanya Silkbase

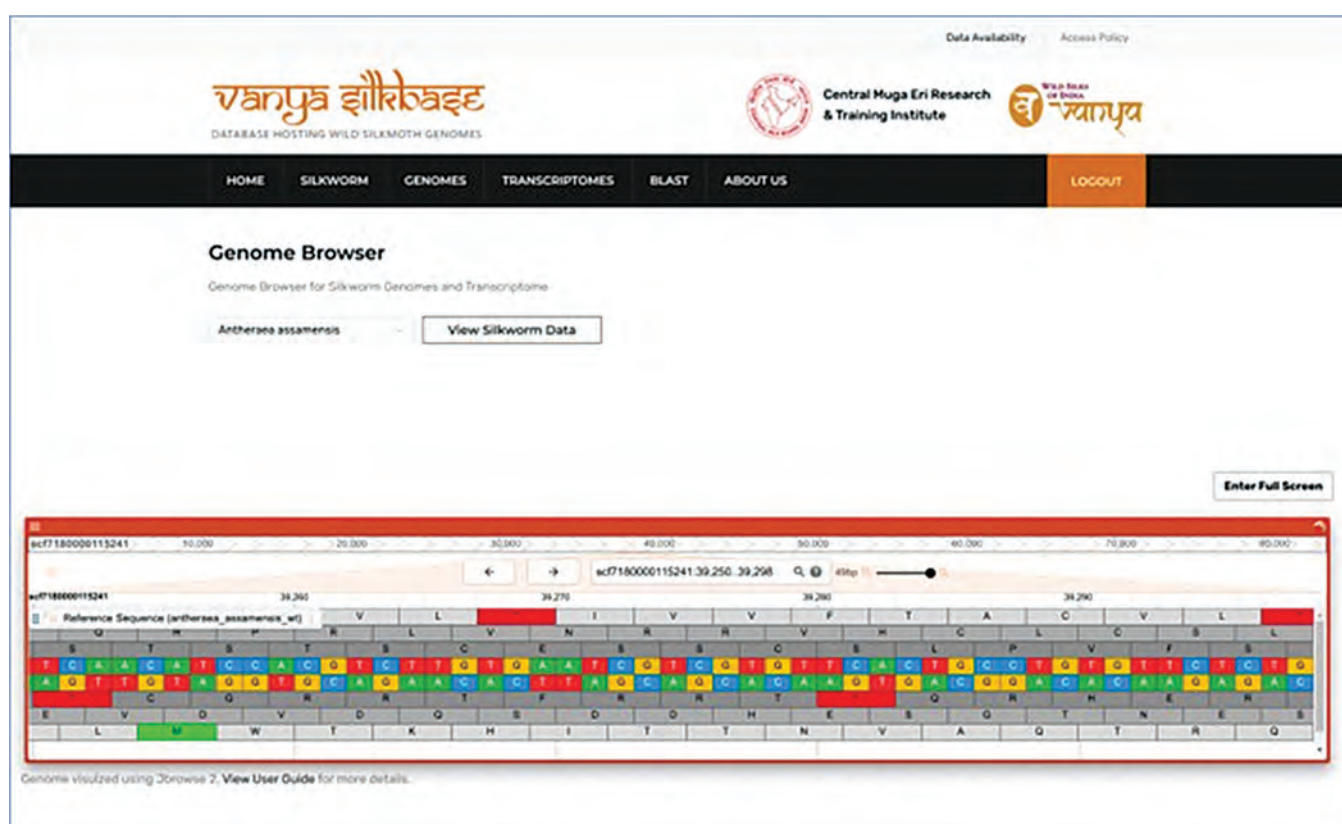


Figure 2: Genome viewer visualizing genome of *Antheraea assamensis* (WT)

Genome assembly of *A. assamensis*

Genome of *A. assamensis* Wild (WT) and Cultivar (CI) was assembled and the assembly completeness was found to be 97.2% for WT and 97.1% for CI. (Table 1).

Table 1: Assembly completeness of *A. assamensis* genes and Genome

Items	<i>A. assamensis</i> - WT genes	<i>A. assamensis</i> - cultivar genes	<i>A. assamensis</i> - wild genome	<i>A. assamensis</i> - cultivar genome
Total BUSCO groups searched	5286			
Complete BUSCOs (C)	5094 (96.4%)	5024 (95.1%)	5141 (97.2)	5135 (97.1%)
Complete and single-copy BUSCOs (S)	4367 (82.6%)	3826 (72.4%)	4991 (94.4%)	4975 (94.1%)
Complete and duplicated BUSCOs (D)	727 (13.8%)	1198 (22.7%)	150 (2.8%)	160 (3%)
Fragmented BUSCOs (F)	76 (1.4%)	96 (1.8%)	45 (0.9%)	43 (0.8%)
Missing BUSCOs (M)	116 (2.2%)	166 (3.1%)	100 (1.9%)	108 (2.1%)

Functional annotation of *A. assamensis* WT and CI genes and unique gene identification

Functional annotation of both *A. assamensis* (WT) and *A. assamensis* (CI) was done. The total number of genes identified were 18385 for *A. assamensis* (WT) and 21606 for *A. assamensis* (CI). Out of the total genes identified 15867 from *A. assamensis* (WT) and 15954 from *A. assamensis* (CI) were annotated. The Genes which were not identified in NCBI-Insecta database are now being searched on larger database i.e., NCBI-nr database. If no BLAST hits were found in NCBI-nr then we can say that these genes are reported for the first time in any organism.

Table 2: Unique gene identification in Muga WT and CI genome

	<i>Muga CI Genome</i>	<i>Muga WT Genome</i>
Total Numbers of Genes identified	21606	18385
Total genes annotated	15954	15867
BLAST Hits NCBI-Insecta	15903	15807
Genes with no BLAST hits on NCBI-Insecta	5703	2578



रेशम उत्पादन विस्तार, आर्थिक और प्रबंधन विभाग
**SERICULTURE EXTENSION, ECONOMICS &
MANAGEMENT DIVISION**



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
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 districts 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 borer 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
- 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%)



Fig. 1 Training program on Muga Silkworm seed production at Lakhimpur from 21-04-2021 to 23-04-2021



Fig. 2 Awareness program and distribution of Foot sprayer and Inputs at Dhekiajuli, Lakhimpur on 30-09-2021



Fig. 3 Awareness program at Laimekuri, Dhemaji on 01-10-2021



Fig.4 Farmers 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	40.5	26.43	21	10.5	27	13.5	28.57



EXTENSION COMMUNICATION PROGRAMMES CONDUCTED DURING THE YEAR 2021-22

#	Name of the Programme	Target for the year 2021-2022			Achievement for the year 2021-2022		
		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	3.00	1	337	2.50
	RSRS Boko	1	200	1.50	1	325	1.50
	RSRS,Imphal	1	200	1.50	1	200	1.50
Sub-Total		3	800	6.00	3	862	5.50
2 Farmers Field days							
	RSRS Boko	4	280	0.60	4	320	0.60
	RSRS,Imphal	4	280	0.60	2	140	0.30
Sub-Total		8	560	1.20	6	460	0.90
3 Awareness programmes							
	RSRS Boko	4	200	0.40	4	260	0.40
	RSRS,Imphal	4	200	0.40	2	100	0.20
	REC, Lakhimpur	5	250	0.50	5	317	0.50
	REC, Fatehpur.	5	250	0.50	5	325	0.50
	REC, Coochbehar	5	250	0.50	5	350	0.50
Sub-Total		23	1150	2.30	21	1352	2.10
4 Tech. demonstrations/ Enlightenment Programmes							
	RSRS Boko	4	80	0.04	4	105	0.04
	RSRS,Imphal	4	80	0.04	1	20	0.01
	REC, Lakhimpur	5	100	0.05	5	115	0.05
	REC, Fatehpur U.P.	5	100	0.05	5	259	0.05
	REC, Coochbehar	5	100	0.05	5	100	0.05
Sub-Total		23	460	0.23	20	599	0.20
Workshops/Seminars & Conferences							
5	CMER&TI, Lahdoigarh	1	100	2.00	1	180	1.70
	RSRS Boko	1	100	2.00	1	50	1.50
	RSRS,Imphal	1	100	2.00	1	65	1.50
Sub-Total		3	300	06.00	3	295	4.70
Grand Total		60	3270	15.73	53	3568	13.40

Sl.	Name of the Programme	Target for the year 2021-2022			Achievement for the year 2021-2022		
		Physical (No)	Beneficiaries (No)	Financial (Rs.in lakh)	Physical (no)	Beneficiaries (No)	Financial (Rs. In lakh)
1.	Krishimela/ Reelers Mela-cum-Exhibition	3	800	6.00	3	862	5.50
2.	Farmers Field days	8	560	1.20	6	460	0.90
3.	Awareness programmes	23	1150	2.30	21	1352	2.10
4.	Tech. demonstrations/ Enlightenment Programmes	23	460	0.23	20	599	0.20
5.	Workshops/Seminars & Conferences	3	300	6.00	3	295	4.70
Grand Total		60	3270	15.73	53	3568	13.40



अधीनस्थ इकाइयाँ की गतिविधियाँ ACTIVITIES OF NESTED UNITS



REGIONAL SERICULTURE RESEARCH STATION (RSRS), IMPHAL, MANIPUR

ONGOING 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 1st crop (April-May, 2021), *Antheraea frithi* moths started emergence after undergoing 140-150 days of pupal diapause. Natural coupling of moths obtained 52% inside the bamboo basket covering with black cloth. Recorded 75 to 80% hatching when the moths allow for 14 hrs of coupling. Chawki rearing conducted in indoor condition by using *L. dealbata*, *Q. serrata* and *Q. grifhithi* twigs and the result indicates about 15-20% mortality. After chawki, adult rearing is 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 43 ± 0.8 cocoons per dfl followed by worms reared on *Q. serrata* with an average cocoon yield of 19 ± 0.6 cocoons per dfl.
- For 2nd crop (September- October), of *Antheraea frithi* seed cocoons are consigned to photoperiodic treatment by providing 16 hrs light (5 am to 5 pm natural light and 5 pm to 9 pm artificial light with 180 LUX) following the procedure of *A. proylei*.
- Emergence of moth started after 28 days of photoperiodic treatment. The emerged male and female moths are mixed together and put in different devices for coupling. Emergence of 54% moths observed when released inside the bamboo basket covering with black cloth followed by 40.66% inside the nylon net. The average fecundity ranges from 185 ± 0.94 to 225 ± 2.35 eggs. The highest average fecundity of 225 ± 2.35 eggs recorded when the moths allow to lay eggs inside monia followed by nylon bag of 219 ± 0.93 eggs. Hatching of 75 to 82% was recorded when moths allow for 14 hrs. of coupling.
- During 2nd crop, chawki rearing of *A. frithi* are conducted in indoor condition by feeding three different food plants viz., *L. dealbata*, *Q. serrata* and *Q. grifhithi* leaves. After chawki rearing, adult rearing is conducted in outdoor condition by feeding *L. dealbata*, *Q. serrata* and *Q. grifhithi* leaves. The result showed that the worms reared on *L. dealbata* recorded 41 ± 0.6 cocoons per dfl followed by 12 ± 0.63 cocoons per dfl when the worms feed on *Q. serrata* and 9 cocoons per dfl by *Q. grifhithi*. During the period 4% of moths are erratically emerged.



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
Funding Agency	: Central Silk Board, Bangalore
Total Budget allocation	: Rs.16.90 (Rs.21.90 in revised)
Total expenditure(during the year)	: Rs. 3.57 lakhs
Scientists involved	: Dr.Y. Debaraj, RSRS, Imphal, PI : Dr. S. Subharani, RSRS, Imphal, CI : Dr. Arun Kumar KP, CMER&TI, CI

Objective:

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

Summary of the findings/ achievements:**Silkworm grainage, rearing and maintenance of generation:**

During spring crop grainage, 2021 prepared the eggs of *Antheraea proylei*, RTRS-1, C-27 and incubated under optimum temperature $26 \pm 1^\circ\text{C}$ and $80 \pm 5\%$ relative humidity until hatching. The larvae were cellularly reared on oak leaves under nylon net upto spinning following standard rearing procedures.

Induction of heat stress:

The fifth instar 3rd day silkworm larvae were subjected to high temperature thermal stress at different temperature regimes (32, 35, 38 °C). The larvae reared at 26 °C were treated as control. After induction of thermal stress, the larvae were reared until cocooning under nylon net in natural fluctuated outdoor conditions. The harvested cocoons were analysed and preserved for continuing the generation.

Differential Expression of HSPs in heat treated *Antheraea proylei*

Haemolymph were collected and centrifuged. The supernatants were collected. Equal amount of total proteins of each sample were separated on a 15% SDS-PAGE. Out of about 14 protein bands separated, 5 major proteins bands which are having high molecular weight are observed to be expressed differentially (increased or decrease) after heat was induced at different temperature. These proteins were further identified by amino acid sequencing.

***Antheraea proylei*:**

- i. Expressions of HSP 19.9, HSP 90 and HSP 60 initially increase at 32 °C but decrease at 35 °C then further increase at 38 °C. Highest expression of HSP proteins were found at 38 °C treated larvae.
- ii. No significant differences were found in the expression of HSP 70 protein.
- iii. Expression of HSP 21 increases with increase in temperature.

RTRS 1:

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

**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. 4.33 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:

- Three Eri food plants, viz., castor, kesseru and tapioca are being maintained following agronomic practices. After conducting grainage activities, prepared dfls of eri silkworm eco- races, breed and strains for rearing.
- Data on average of three crops revealed that highest ERR was recorded at par on Borduar (84.66 %) and C2 breed (84.42 %) in low altitude.
- In high altitude also it was almost at par in both Borduar (81.5 %) and C2 (80 %) with higher SR % was also recorded in both the races/ breed.
- Among the strains, Yellow plain and Greenish blue plain, showed with higher ERR in both the rearing sites, i.e., in low altitude (YP-82 % & GBP-77 %) and in high altitude (YP-80 % & GBP-75 %) respectively.
- Data on performance of eri silkworm (Borduar) on three food plants revealed that castor showed most preferred food plant with highest ERR (80% to 85%) along with all the economic characters in both the rearing sites.



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	: October, 2021- September, 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:

- Project was initiated recently after coding.
- Recruitment of 2 (two) JRF completed.
- Initiated survey and collection of oak tasar silk moths from different regions of Manipur.
- Initiated evaluation of best food plant for *Antheraea proylei* for egg production.



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 will be tested at Imphal test centre as assigned. Plantation was raised from saplings supplied from CSR&TI, Berhampore. Plantation of five varieties already completed with six replications in RBD layout. Plants are being maintained following recommended agronomical practices followed by required cultural practices. Leaf yield data collection for two crops already completed and raw data already sent to CSR&TI, Berhampore for compilation. Nursery propagation studies just initiated. Nursery data collection will be started shortly.

**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 schedule, recording of data on different growth parameters have been conducted for the test varieties during July, 2021; October, 2021 and March, 2022. The highest leaf yield per plot was recorded in “C9” with 36.42kg followed by “C2038” with 32.95kg during July, 2021. The raw data has been sent to CSR&TI, Berhampore for compilation.



EXTENSION ACTIVITIES

Sericulture KrishiMela cum Exhibition held at RSRS, Imphal on 17.03.2022



A Sericulture Krishi Mela cum exhibition was organized by Regional Sericultural Research Station, CSB, Mantripukhri, Imphal on 17th March 2022 at RSRS, Imphal. The programme was graced by Shri L. Geetchandra Singh, MCS, Director of Sericulture, Govt. of Manipur as Chief Guest, Dr. K. Sathyanarayana, Director, Central Tasar Research and Training Institute, CSB, Ranchi as Special Guest and Dr. K. M. VijayaKumari, Director, CMER&TI, Lahdoigarh, Jorhat as president. All the dignitaries 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. An exhibition with 13 stalls showcasing yarn samples, silk fabrics, cocoons, wild silk moths, reeling machines, different sericulture products was also set up which evoked much interest among farmers and invitees. Two booklets were released on the occasion. One farmer each from oak tasar, mulberry, muga sector were awarded best farmer prize based on the rearing performance during 2021. The programme was actively participated by about 200 participants including rearers, SHG, NGO, reelers, weavers, entrepreneurs and Officials from Central and State sericulture Departments.

Brainstorming Workshop held at RSRS, Imphal on 16.03.2022



A Brainstorming Work Shop on **“Promotion of Oak Tasar culture”** was organized at Regional Sericultural Research Station, Imphal on 16th March 2022 under the aegis of Central Muga Eri Research & Training Institute, Lahdoigarh, Jorhat, Assam. The programme was graced by Shri L. Geetchandra Singh, MCS, Director of Sericulture; Govt. of Manipur as Chief Guest, Dr. K. Sathyanarayana, Director, Central Tasar Research and Training Institute, CSB, Ranchi as Guest of Honour and Dr. K. M. VijayaKumari, Director, CMER&TI, Lahdoigarh, Jorhat presided over the function.

At the outset all the participants of the workshop were welcomed by Dr. Y. Debaraj, Scientist-D & Head, RSRS, Imphal. After that Dr. K. M. VijayaKumari, Director, CMER&TI, Lahdoigarh, Jorhat spoke about the objective of the workshop and its importance for the development of Oak tasar culture in North Eastern and

North Western states of India where oak tasar culture is practiced. Dr. K. Sathyanarayana, Director, Central Tasar Research and Training Institute, CSB, Ranchi expressed about the present need and co-ordination between NE & NW states for future development of oak tasar culture. Shri L. Geetchandra Singh, MCS, Director of Sericulture, Govt. of Manipur highlighted about the present status of oak tasar culture and opined that new project on oak tasar will be included in the Silk Samagra-2 for the benefit of the farmers. After lighting of the inaugural lamp, the dignitaries and participants from different states were felicitated. Further deliberations were made by the invited speakers on different topics viz., i) “Status, problems and prospects and future strategies for development of oak tasar culture in Manipur” presented by Shri. L. Geetchandra Singh, MCS, Director of Sericulture, Govt. of Manipur, ii) “Strategies to improve Oak tasar host plant for quality leaf production” presented by Dr. N. Ibotombi Singh, Scientist-D (Retd.), RSRS, Imphal, iii) “Technologies on grainage and rearing of oak tasar silkworm” presented by Dr. L. Somen Singh, Scientist-D, RSRS, Imphal, iv) “Status of Oak tasar culture in UttaraKhand, its problems and prospects and future strategies for development” presented by Shri Anand Kumar Yadav, Director of Sericulture, Govt. of UttaraKhand and v) “Implications of oak tasar culture and its remedial measures” presented by Dr. N. Ibohal Singh, Scientist-D (Retd.), RSRS, Imphal and Ex-OSD-cum-Consultant (Sericulture), Govt. of Manipur.

In the afternoon session, panel discussion on oak tasar culture, discussion with stakeholders including farmers/reelers in pre- and post-cocoon sectors, discussion on “Specific interventions needed to achieve SDGs in oak tasar culture” and discussion on “Preparation of time bound action plan for enhancing the production of oak tasar” and various recommendations were made by the panel experts. One progressive farmer, Mr Lallun requested the forum to include cocoon storage-cum-resting shed and also to increase cocoon price so as to benefit for the farmers. Some lady entrepreneurs also expressed their opinion that they required more oak tasar cocoon for enhancement of reeling and weaving activities so that their income can be increased. About 65 participants including Directors/ representatives/ officials of Department of Sericulture, Govt. of Manipur, Assam, Mizoram, Nagaland and UttaraKhand, CSB Scientists from CMER&TI, Jorhat, RSRS, Bhimtal, CTR&TI, Ranchi, RSRS, Imphal, Serifed, Manipur, Retired Scientists of RSRS, Imphal, Entrepreneurs, Reelers, Weavers and farmers attended the programme. The programme ended with vote of thanks in the chair.

Field Day programme at Phayeng Village on 21.03.2022



A field day programme was organized on 21.03.2022 at Phayeng 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 attended the event.

Field Day programme at Keibi Village on 23.03.2022



A field day programme was organized on 23.03.2022 at Keibi Village, Imphal East District to create awareness amongst the farmers about the improved sericulture technologies particularly in oak tasar and eri culture and 70 farmers participated in the event along with staff of DOS and CSB attended the event.

Awareness programme held Lairenjam Village, Imphal west on 22.03.2022



An awareness programme was organized on 22.03.2022 at Lairenjam Village, Imphal west District to create awareness amongst the farmers about the improved sericulture technologies particularly in mulberry and eri culture and 50 farmers participated in the event along with staff of DOS and CSB attended the event.

Awareness programme held at Kairang Village, Imphal west on 23.03.2022



An awareness programme was organized on 23.03.2022 at Kairang Village, Imphal west District to create awareness amongst the farmers about the improved sericulture technologies particularly in mulberry and eri culture and about 50 farmers participated in the event along with staff of DOS and CSB attended the event.

Group Discussion held at TSF, Yumnam Khunou, Imphal East District on 11.01.2022



A Group Discussion programme was organized on 11.01.2022 at Tasar Seed Farm, Imphal East district, to demonstrate the various technologies developed by RSRS, Imphal during the ongoing spring crop grainage. Twenty officials of DOS and CSB participated in the programme.

Meteorological Data at RSRS, Imphal

Months	Criteria	Temperature (°C)		Relative humidity (%)	Rainfall (mm)	Rainy days (no.)
		Max.	Min.			
April,21	Mean	30.69	15.19	52.75	57.1	5
	Range	31-33	12-15	31-84		
May,21	Mean	29.95	17.70	74.9	56.8	5
	Range	29-33	17-18	51-91		
June,21	Mean	29.81	19.89	80.88	119.98	10
	Range	28-33	17-20	51-92		
July,21	Mean	30.14	20.24	70.75	149.14	10
	Range	30-31	17-24	50-85		
Aug.,21	Mean	28.82	21.5	75.21	72.79	9
	Range	28-31	20-23	58-92		
Sept.,21	Mean	31.13	19.64	78.75	108.41	10
	Range	31-34	17-21	55-92		
Oct.,21	Mean	29.97	17.28	70.44	82.21	9
	Range	29-33	15-20	35-85		

Months	Criteria	Temperature (°C)		Relative humidity (%)	Rainfall (mm)	Rainy days (no.)
		Max.	Min.			
Nov.,21	Mean	28.79	11.45	62.78	8.68	2
	Range	28-31	7-14	49-81		
Dec.,21	Mean	24.56	7.10	68.70	75.72	3
	Range	24-27	6-8	45-95		
Jan., 22	Mean	24.20	5.75	62.4	42.17	6
	Range	23-26	4-6	33-89		
Feb., 22	Mean	24.25	5.06	59.37	35.88	5
	Range	24-27	4-6	24-89		
March, 22	Mean	32.28	9.46	51.08	56.67	4
	Range	26-31	10-16	26-81		

Plan for land use and Resource Conservation:

A total of 25 acres of land with systematic plantations are available under RSRS, Imphal and Field Lab., T. Khullen which are utilized for conducting seed crop rearing and experimental rearing. Three *Antheraea* species and different oak tasar silkworm breeds, three eri eco-races/ breed and muga silkworm species are being maintained at RSRS, Imphal GPB. The primary food plants of oak Tasar, eri, muga and mulberry are being maintained in the GPB of RSRS, Imphal.



REGIONAL SERICULTURE RESEARCH STATION (RSRS), BOKO, ASSAM

Highlights of activities/achievements

- Sexual multiplication of S3 & S6 morphotypes of Som, their maintenance and supply to stakeholders as and when needed.
- A total of 21550 (against the target of 20000) seedlings were raised apart from supplying 1150 numbers of seedlings were supplied to MSSO Guwahati, DOS Assam & private farmers.
- Under extension and technology awareness programme 1010 farmers were covered through Krishimela, Awareness Programmes, Field Days, and Technology Demonstration Programme.
- Under training programme, 4 batches of farmer's skill Training, 3 batches of Technology Orientation Programme and 2 batches of Post Cocoon Training Programme were conducted and 235 framers/students were trained.

- Under commercial Muga crop rearing 1150 g DFLs were reared against target of 2500 g DFLs to produce 24300 Nos. of commercial cocoons.
- The centre generated a total revenue of Rs46350/-

CONCLUDED PROJECT:

Project Code: MOE 05003 EF

Project Title: Socio-economic uplifting of farmers through adoption of improved technologies and skill development in eri culture

Project Period	: November, 2018 to October, 2021
Funding Agency	: DST
Total Budget allocation	: Rs.:21,57,790
Total expenditure (during the year)	:
Scientists involved	: Dr H Barman, RSRS, Boko, PI
	: Sh. SAS Rehman, RSRS, Boko, CI

Objectives:

1. To adopt improved technologies (both pre and post cocoon sectors) at farmers' level
2. To improve the economies of scale through group Approach
3. Diversification of Eri-culture towards income and employment generation

Summary of the findings/achievements:

Following technologies have been adopted by beneficiaries.

Sl.	Title of Technology	Score	Adoption Level
1	Seasonal Castor Garden Raising	02	100
2	Perennial Kesseu Garden Raising	02	100
3	Intercropping Castor & Kesseru garden with ginger and colocasia.	01	50
4	Rearing (culturing) of Eri Silkworm C-2 breed.	01	50
5	Seed Cocoon Production technologies.	01	50
6	Production of DFLs (Eri silkworm eggs)	00	0*
7	Overlapping Eri silkworm crops	01	50
8	Conversion of Sericulture wastes & litters into manure	01	50
9	Value addition to cocoon shells	00	0*
10	Early stage rearing technology	01	0

*Here, 02 means 100 percent; 01 means 50 percent; 00 means 0 percent,
Below 50 percent adoption level is considering as 0.
Over all technology adoption percentage is 50.*

In each village 10 nos. beneficiaries worked together as a functional group and achieved satisfactorily in uplifting their annual economic scale which is far better than their baseline economic scale (3 times more).

Baseline Economic Scale of Beneficiary was Rs. 5,098/-

Present Economic Scale of Beneficiary is Rs.16,517/-

Effective technologies practiced that contributed in uplifting economic scale are as under:

A. Intercropping food plant gardens.

- Average annual income from Ginger intercropping is Rs.6311/-
- Average annual income from Colocasia intercropping is Rs.6228/-

B. Rearing.

- Due to development of food plant gardens, number of crops and DFLs reared per annum increased to 5 nos. and 70 nos. respectively at an average.
- Annual income from rearing DFLs —
- From Cocoon Shell:Rs. 3832.80/- average per beneficiary.
- From Pupa sale:Rs. 5197.40/- average per beneficiary.

C. Gardening of both seasonal castor and perennial kesseru plants.

- This resulted more leaf production throughout the year that helped increased crops and DFLs rearing per annum.

D. Overlapping Eri silkworm crops.

- Those beneficiaries who has less rearing space, practiced overlapping crops thereby increased DFLs rearing capacity.

E. Rearing of Eri Silkworm C-2 breed.

- Cocoon shell weight of C2 breed is 0.4 grams whereas other eco-races are 0.25 to 0.3 grams. Thus rearing C2 breed helped in extra gain in terms of weight and money per DFL.

F. Seed Cocoon Production technologies.

- Some of the beneficiaries practiced seed cocoon production and sale their produces as seed at higher rate.

G Early stage rearing technology.

- Beneficiaries adopted early stage rearing technology, thereby reduced mortality of worms that increased cocoon production per DFL reared.

Income Generation through intercropping food plant gardens:

All beneficiaries practiced intercropping of their Castor and Kesseru food plant gardens with Ginger and Colocasia. They generated extra income as under:

Ginger intercropping : Rs.6311.00 Per beneficiary

Colocasia intercropping : Rs.6228.00 per beneficiary

Litters and debris of each Eri crops had been collected, stored and used in other agriculture crops by each of 200 nos. beneficiaries and got benefit in terms of increased production.

EXTENSION ACTIVITIES

Extension Communication Programme:

Particulars	Target	Achievement (No. of Beneficiaries covered)
Krishi Mela	1	1 (325)
Field Day	4	4 (320)
Technology Awareness programme	4	4(260)
Technology Demonstration	4	4 (105)
Group Discussion	-	-
Workshop	-	-
Training	-	-

Meteorological Data

Year	Month	Temperature (°C)		Relative Humidity %		Nos. of rainy Days	Rain fall (mm)
		Max.	Min.	Max.	Min.		
2021	April	36	15	92	41	12	214
	May	36	19	92	41	22	595
	June	37	22	92	41	10	295
	July	37	24	92	46	16	470
	August	37	24	92	51	11	188
	September	36	22	92	53	10	326

	October	33	18	92	49	10	233
	November	31	15	92	53	10	10
	December	26	9	90	42	-	-
2022	January	26	8	89	42	2	2
	February	29	8	89	53	2	30
	March	36	11	90	47	3	17

Plan for land use and Resource Conservation :

Particulars	Target	Achievement
Raising of quality Som/Soalu planting material (Nos.)	20000	21550
Supply of Som/Soalu planting materials (Nos.)	20000	1150
Muga Dfls rearing (Nos.)		
Commercial	2500	800
Seed	700	200
Muga Cocoons production Nos.		
Commercial	1500000	24300
Seed	28000	-
Muga Dfls production (Nos.) Rs. 8.00/- Per g	7000	-
Muga Dfls supply (g.)	7000	-
Vermicompost Production (kg)	20000	-

Total acre of plantation: 24.5 acre plantation of Som and Soalu with 2.5 acre nursery

Available host plant: 10044 plants and 20000 Seedlings/saplings.

Land area under plantation, Area of building and roads, vacant and unutilized land area

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



Farmers Skill Training at Bogajuli



Field Day at Bormohra Krishnai



Field Day at Bormohra, Krishnai



Training on Post Cocoon, Lengupara



Technology Orientation Programme at Borihut



International Yoga Diwas



Farmers Skill Training at Parkijuli Boko



Technology Orientation Programme at J N College, Boko



Farmers Skill Training



Awareness Programme Pachim Dairang, Krishnai



Awareness Programme at Pachim Dairang, Krishnai



Training on Post Cocoon



Krshimela at RSRs, Boko



Krshimela at RSRs, Boko



Krshimela at RSRs, Boko



*Tehnology Orientation
Programme at J N College, Boko*



*Farmers Skill Training
Amlaiguri, Nagapur*



*Awareness Programm at PDU
College, Amjonga*



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

Highlights of activities/achievements

- Eri silkworm rearing of 20 Eri DFLs (10 DFLs control+10 DFLs Base Land) was conducted at EREC, Fatehpur under the piolet project. Rearing Data like average fecundity, hatching %, larval duration, collection of mature worms, larval weight, yield, cocoon weight, shell weight and SR % etc. were recoded under the project.
- Under extension and technology awareness programme 584 farmers were covered through Awareness Programmes, Field Days, and Technology Demonstration Programme in Uttar Pradesh and Gujarat states.
- Under training programme, 4batches of farmer's skill Training, 2 batches of Technology Orientation Programme, 01 Hand's on Training on Eri Silkworm Rearing to Castor Growing Farmers of Vill. Haripura, Jethipura, Pimpodar of Sabarkantha District of Gujarat, 01 farmers' skill training of DoS, Bihar and 01 farmers' skill training of DoS, UP were conducted and 221 framers/students were trained.
- Reports on Castor disease/ pest in commercial crops (Oct-Nov 2021 & Feb-March 2022) were prepared and submitted to office.

- Swachhta Pakhwada (01.03.2022 To 15.03.2022) was organized at following places: Office Campus, at Jagannathpur village, Fatehpur, District Women Govt. Hospital, Fatehpur, Railway Station, Fatehpur 168 CSB Official, DoS Official, Eri Farmers, Local bodies involved in this Programme.
- Meteorological Data of EREC, Fatehpur (U.P.) have been recoded for the year 2021-22.

EXTENSION ACTIVITIES

Extension Communication Programme

Particulars	Physical Target (Beneficiaries Target)	Achievement (No. of Beneficiaries covered)
Technology Awareness programme	5 (250)	5 (325)
Technology Demonstration	5 (100)	5 (259)
Training	6 ()	6 (125)
Farmers Skill Training	4 (95)	4 (95)
Technology Orientation Programme	2 (30)	2 (30)

Meteorological Data:

Month	Temperature °C (range)		Relative Humidity (%) range	
	Mani.	Maxi.	Mini.	Maxi.
April, 2021	20-24	36-44	32-36	45-84
May, 2021	23-29	35-46	32-41	43-80
June, 2021	23-30	32-45	28-65	52-90
July, 2021	25-28	32-38	35-61	56-88
Aug., 2021	23-28	30-34	33-65	85-90
Sept., 2021	21-26	30-34	30-66	67-88
Oct., 2021	14-28	30-34	22-61	72-90
Nov., 2021	11-16	26-35	19-34	68-92
Dec., 2021	05-14	18-27	18-52	68-93
Jan., 2022	04-11	16-25	19-47	75-94
Feb., 2022	06-15	20-28	16-47	68-93
Mar., 2022	09-25	28-42	28-45	78-95

Photographs of activities



Technology Awareness Meet Programme in Gujarat



Technology Awareness Meet Programme in Gujarat



Farmer Skill Training Programme at EREC, Fatehpur



Farmer Skill Training Programme at EREC, Fatehpur



Technology Orientation Programme at EREC, Fatehpur



Technology Orientation Programme at EREC, Fatehpur



Hand's on Training on Eri Silkworm Rearing to Castor Growing Farmers of Vill. Haripura, of Sabarkantha District of Gujarat.



Hand's on Training on Eri Silkworm Rearing to Castor Growing Farmers of Vill. Haripura, of Sabarkantha District of Gujarat.



Swachhta Pakhwada (01.03.2022 To 15.03.2022)



Swachhta Pakhwada (01.03.2022 To 15.03.2022)



RESEARCH EXTENTION CENTRE, COOCHBEHAR, WEST BENGAL

Highlights of activities/achievements

- Under extension and technology awareness programme, REC Coochbehar were conducted five Technology Awareness Programmes on 22.09.2021, 29.09.2021, 4.10.2021, 9.11.2021 and 11.02.2022 and five Technology Demonstration Programmes on 23.9.2021, 25.9.2021, 6.10.2021, 17.02.2022 and 18.02.2022 to covered 320 farmers of West Bengal.
- Swachhta Pakhwada (01.03.2022 to 15.03.2022) was organized at REC, Coochbehar.
- Muga silkworm rearing conducted at different places to trained the farmers in Darjeling, Kalingpong and Coochbehar area.



Technology Awareness programme conducted at Primary school West Chengmari Alipurduar.



Technology Awareness programme conducted at Coochbehar.



Technology Awareness programme conducted at Lower Soreng, Darjeeling, West Bengal.



Technology Awareness programme conducted at Primary school, Salkumarhat village, Coochbehar.



Technology Demonstration programme conducted at primary school, Kumargram



Technology Demonstration programme conducted at RSS hill zone, UBKV, Kalimpong



IMPORTANT EVENTS ORGANIZED BY CMER&TI, LAHDOIGARH

Research Advisory Committee (RAC) meeting



39th Research Advisory Committee meeting was held on 6th November 2021 at this Institute.



CMER&TI organized a Vanya Resham Krishi Mela at Chungtia, Mokokchung, Nagaland on 22.03.2022



Ethnic Day was celebrated on 28th October 2021



National Handloom Day on 7th August 2021 to honour the contributions of the handloom weaving community in the socio-economic development of India



CMERTI attended the august programme Vanijya Utsav organised by Department of Trade and Commerce, Govt. of Arunachal Pradesh, Itanagar from 23-24 September 2021



CMER&TI organized a workshop on 21.12.2021 at Gourisagar, Sibasagar District with theme on Technology Intervention on Muga Culture.



CMER&TI staff observed Martyrs' Day on 30th January 2022 at staff quarter campus paying homage to all bravehearts who sacrificed for the nation with 2 minutes silence and Shraddhanjali to Bapu on his Punya Tithi.



Training Module in Sericulture for Scientists of Krishi Vigyan Kendras (KVK) under convergence of sericulture extension training for ICAR-KVKs during 4th to 8th October 2022 at this Institute.



Technology Orientation Training programme for College students of Sibsagar and Kakojan w.e.f. 27 to 31 December 2021



Participated in 10th India International Silk Fair organized by the Indian Silk Export Promotion Council from 18-20 December 2021 at Gurugram, India



Plantation drive at CMERTI on the occasion of World Environment Day 2021



CMER&TI organised five days Farmers Skill Training programme at Tamulbari, Titabor, Jorhat from 22-26 February 2022



CMER&TI celebrated International Women's Day on 8th March 2022



CMER&TI, CSB, Lahdoigarh celebrate 75th Independence Day



Dr. K.M. Vijayakumari, Director visited at farmers field in Manipur and encouraged the production of muga, eri and oak tasar silk cocoons at farmers level.



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 32 different locations against a target of 32 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	Reduction in uzi infestation below 10%. The OST conducted in 2 nd crop suggested that percentage of uzi infestation was 6 to 8 % with IPM as against 15 to 18 % in control.
2	Validation of use of Biopesticides for control of insect pest infesting <i>Q. serrata</i> .	RSRS-2 & DOS-3	RSRS-2, & DOS-3	Recorded 70-72% reduction of pest infestation on 14 th day after application of Bioneem.
3	Multi-location trials of muga breeds CMR-1 CMR-2	CMERTI-1, RSRS-3, DOS-2	6 locations	Multi-location trials of muga breeds CMR-1 and CMR-2 was conducted in May-June season this at 6 locations.
4	Multi-location trials of Eri breeds/ cross breeds	CMERTI-1, & RSRS-3, & DOS-2	6 locations	Multi-location trials of eri breeds/cross breed was conducted in May-June season this at 6 locations.
5	Development of seed preservation technology for Muga silkworm	CMERTI-2	CMERTI-2	A total of 4400 Muga seed cocoons were preserved in cold storage as preservation schedule for 42 days. 85.18% moths were emergence in which 6.83% moths found healthy and 78.35% found crippled. Emerged moths are weak, unhealthy and wings are not properly spread therefore, cold storage preservation practice could not use for coupling purpose. It is also observed that moths are unable to lay eggs and the eggs are also depressed and unfertilized. The un-emerged cocoons were recorded 14.82%.
6	Trial of formulated volatiles application for enhancing egg laying capacity of Muga silk moth during commercial crop.	RSRS- 2 & CMERTI-1	CMERTI-1	Blends are presently being test verified at main Station.

#	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.
8	Validation of muga silkworm egg treatment for uniform hatching and higher survivability of young larvae.	RSRS-1 & CMERTI-3	CMERTI-1	Experiment of egg treatment is initiated during May, 2022.
9	Rearing management of Muga silkworm in cooler region during summer	RSRS- 4 & CMERTI-1	RSRS- 4 & CMERTI-1	Muga silkworm rearing in cooler regions viz. Wokha, Nagaland and Rompara, Meghalays were 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.



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

OFT of 12 technologies were carried out at different locations covering 485 beneficiaries against a target of 700 beneficiaries.

#	Name of the Technology	Beneficiary Target	Achievement	Anticipated Impact
1	Popularization of Kesseru Eri host plant HF-005 and HF-008	60	66	9500 Kesseru (HF-008 & HF-005) seedlings were distributed to 66 Eri farmers.

#	Name of the Technology	Beneficiary Target	Achievement	Anticipated Impact
2	Popularization of Borpat Eri host plant	90	81	5085 Borpat seedlings were distributed.
3	Popularization of other host Plants (Som, Dighloti and Castor)	250	151	125 kg Castor (NBR) seeds and 3050 Som seedling were distributed for block plantation in Sivasagar, Jorhat, Golaghat and Dibrugarh area. Details of results are showing in ongoing project of Host Plant Division.
4	LED light trap for control of muga insect pests	30	30	Trails were conducted in upper Assam, lower Assam and middle Assam which shows that pest infestation 20-30% decreases 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	-	OFT was not conducted during the summer season due to Covid-19 restriction.
6	Formulation for controlling bacterial flacherie disease in Muga silkworm.	50	40	Formulation was supplied to the farmers to control the Flacherie disease during the rearing in month of May whereas crop was failed due to continuous rain.
7	Validation of use of PET bottles for uzi trap in muga silkworm rearing	30	10	Installation of PET bottles for uzi traps had been conducted at farmer's field in upper Assam. PET bottle device trapped wasps predator, butterflies and other small unidentified beetles only. Uzi fly not trapped in this device.
8	Integrated Practice of ITK and Modern Technology for Muga Silkworm Seed production.	50	35	Results show that the fecundity increase by 11.9% over the normal practice.
9	Integrated Practice of ITK and Modern Technology for Higher Muga cocoon yield	40	36	OFTs result show that the significant enhancement of cocoon yield (23.4%) and ERR (21.8%) over the existing recommended practice.
10	Establishment and Popularization of	10	10	Rearing performance of C27 breed showed 20-25 cocoons per dfl as against 15-19 cocoons per dfl

#	Name of the Technology	Beneficiary Target	Achievement	Anticipated Impact
	new breed C27 among farmers			in <i>A. proylei</i> (control) during 2 nd crop.
11	Validation of use of PET bottles for uzi trap in oak tasar silkworm rearing	30	16	Percentage of uzi infestation recorded was 10 -13% with PET bottle uzi trap as against 15-18 % 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 22 - 25 cocoons per dfl as against 16-19 cocoons per dfl in control during 2 nd crop.



CAPACITY BUILDING AND TRAINING PROGRAMMES FOR FINANCIAL YEAR OF 2021-2022

#	Name of the Training Programme	Target		Achievement	
		Physical	Financial	Physical	Financial
1	Exposure visit for Technology Awareness	-	-	-	-
2	Farmers' Skill Training	16	18.00	16	16.05
3	Technology Orientation Programme (Officials from DoS & CSB)	8	7.60	8	6.50
4	Training under Post cocoon sector	6	5.40	6	4.53
5	Training under Sericulture Resource Centre	45	6.75	45	1.76
6	Training under STEP by Institute	-	-	-	-
	Sub Total	75	37.75	75	28.84
7	Training funded under - NON CBT	4	-	6	-
8	Training funded under - NON CSB	-	-	-	-
	Sub Total	4	-	6	-
	Grand Total	79	37.75	81	28.84



राजभाषा हिंदी गतिविधियों की मुख्य विशेषताएं

- संस्थान में राजभाषा कार्यान्वयन समिति की तीन बैठकों एवं तीन एकदिवसीय हिंदी कार्यशाला का आयोजन किया गया।
- नगर राजभाषा कार्यान्वयन समिति, जोरहाट द्वारा वर्ष २०१६-२० के दौरान राजभाषा हिंदी के उत्कृष्ट कार्यान्वयन हेतु केन्द्रीय मूगा एरी अनुसंधान व प्रशिक्षण संस्थान को पुरस्कार का नाम से पुरस्कृत किया गया तथा हिंदी में 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 शुरू किया गया। इसके उत्तर्गत तिमाही (जनवरी दृ मार्च २०२१) में बेहतर कार्य निष्पादन करने पर स्थापना अनुभाग, केन्द्रीय मूगा एरी अनुसंधान व प्रशिक्षण संस्थान को प्रदान किया है।
- संस्थान में प्रथम एकदिवसीय हिंदी कार्यशाला का आयोजन किया गया, जिसमें श्री अजय कुमार, सचिव, नगर राजभाषा कार्यान्वयन समिति, जोरहाट, उत्तर-पूर्व विज्ञान तथा प्रौद्योगिकी संस्थान, जोरहाट ने विभागीय हिंदी शब्दावली, नोटिंग ओर मौसदा के बारे में पूरी जानकारी दिया।
- संस्थान में द्वितीय एकदिवसीय हिंदी कार्यशाला की आयोजन किया गया जिसमें वायु सेना विद्यालय, जोरहाट के हिंदी भाषा के शिक्षका श्रीमती काईमों काला माहातों ने हिंदी को सरलरूप में कैसे प्रयोग करेंगे उस पर चर्चा किया तथा इस संस्थान द्वारा हिंदी में किये जा गहे प्रयासों की सराहना भी किया।
- एकदिवसीय हिंदी कार्यशाला में श्री गजेन टाय, वरिष्ठ हिंदी अनुवादक (सेवा निवृत्त), केमूएवप्रसं, लाहदोईगड़ ने भाग लिया और विभागीय हिंदी शब्दावली और राजभाषा हिंदी के बारे में के बारे में पूरी जानकारी दिया और कार्यशाला में व्यक्तिगत प्रशिक्षण का आयोजन भी किया गया।
- दिनांक १ सितम्बर से १४ सितम्बर, २०२१ तक हिंदी पखवाड़ा और हिंदी दिवस का आयोजन किया गया जिसमें संस्थान के सभी आधिकारी, कर्मचारी और दक्षता कुशल कर्मियों के लिए विभिन्न प्रतियोगिताओं का आयोजन किया गया।



संस्थान में राजभाषाहिंदी कार्य का सारांश

केन्द्रीय रेशम बोर्ड																															
केन्द्रीय मूगा एरी अनुसंधान एवं प्रशिक्षण संस्थान, लाहदोईगड़, जोरहाट, असम																															
तिमाही अवधि	धारा 3(3) अनुपालन		हिंदी में प्राप्त पत्र			क क्षेत्र को प्रेषित पत्र			ख क्षेत्र प्रेषित पत्र			ग क्षेत्र को प्रेषित पत्र			हिंदी में लिखी गई टिप्पणियों/पृष्ठों की संख्या		अंग्रेजी में लिखी गई टिप्पणियों/पृष्ठों की संख्या		कुल लिखी गई टिप्पणियों/पृष्ठों की संख्या		हिंदी में लिखी गई टिप्पणियों/पृष्ठों की संख्या										
	कुल ज्ञापन पत्र	हिंदी	अंग्रेजी	कुल प्राप्त पत्र	हिंदी	अंग्रेजी	कुल	हिंदी का %	अंग्रेजी	कुल	हिंदी का %	A-A 100%, B-A 100%, C-A 65%	A-A 100%, B-B 100%, C-B 65%	A-C %, B-A 60%, C-C 65%	हिंदी में लिखी गई टिप्पणियों/पृष्ठों की संख्या	अंग्रेजी में लिखी गई टिप्पणियों/पृष्ठों की संख्या	कुल लिखी गई टिप्पणियों/पृष्ठों की संख्या	हिंदी में लिखी गई टिप्पणियों/पृष्ठों की संख्या	अंग्रेजी में लिखी गई टिप्पणियों/पृष्ठों की संख्या	कुल लिखी गई टिप्पणियों/पृष्ठों की संख्या											
	कुल ज्ञापन पत्र	हिंदी	अंग्रेजी	कुल प्राप्त पत्र	हिंदी	अंग्रेजी	कुल	हिंदी का %	अंग्रेजी	कुल	हिंदी का %	A-A 100%, B-A 100%, C-A 65%	A-A 100%, B-B 100%, C-B 65%	A-C %, B-A 60%, C-C 65%	हिंदी में लिखी गई टिप्पणियों/पृष्ठों की संख्या	अंग्रेजी में लिखी गई टिप्पणियों/पृष्ठों की संख्या	कुल लिखी गई टिप्पणियों/पृष्ठों की संख्या	हिंदी में लिखी गई टिप्पणियों/पृष्ठों की संख्या	अंग्रेजी में लिखी गई टिप्पणियों/पृष्ठों की संख्या	कुल लिखी गई टिप्पणियों/पृष्ठों की संख्या											
	कुल ज्ञापन पत्र	हिंदी	अंग्रेजी	कुल प्राप्त पत्र	हिंदी	अंग्रेजी	कुल	हिंदी का %	अंग्रेजी	कुल	हिंदी का %	A-A 100%, B-A 100%, C-A 65%	A-A 100%, B-B 100%, C-B 65%	A-C %, B-A 60%, C-C 65%	हिंदी में लिखी गई टिप्पणियों/पृष्ठों की संख्या	अंग्रेजी में लिखी गई टिप्पणियों/पृष्ठों की संख्या	कुल लिखी गई टिप्पणियों/पृष्ठों की संख्या	हिंदी में लिखी गई टिप्पणियों/पृष्ठों की संख्या	अंग्रेजी में लिखी गई टिप्पणियों/पृष्ठों की संख्या	कुल लिखी गई टिप्पणियों/पृष्ठों की संख्या											
अप्रैल-जून, 21	30	3	-	22	20	02	05	00	05	100	-	-	-	85	236	64	25	20	45	22	70	42	36	48							
जुलाई-सितंबर, 21	42	4	-	29	26	03	04	00	04	100	-	-	-	203	339	60	40	15	66	22	106	37	38	41							
अक्टू-दिसंबर, 21	38	3	-	16	15	01	03	02	5	60	-	-	-	239	383	68	33	12	34	47	67	59	49	24							
जनवरी-मार्च, 21	33	3	-	36	33	03	05	02	07	71	-	-	-	310	455	68	56	25	45	25	101	10	55	25							
तिमाही अवधि	तिमाही के दौरान आयोजित कार्यशाला की तिथि एवं अधिकारियों/कर्मचारियों की संख्या			रामाकास की बैठक की तिथि			हिंदी पखवाड़ा/दिवस की तिथि			कुल कर्मचारियों/अधिकारियों की संख्या			हिंदी में कार्यसाधक/प्रवीणता प्राप्त अधिकारियों/कर्मचारियों की संख्या			हिंदी में मूल कार्य करने वाले कर्मचारियों/अधिकारियों की संख्या			कंप्यूटर पर हिंदी में कार्य करने वाले अधिकारियों/कर्मचारियों की संख्या			इकाई के अधिकारियों द्वारा किए गए राजभाषा निरीक्षण की तिथि, निरीक्षित कार्यालय एवं निरीक्षण किए गए अधिकारियों के नाम व पदनाम									
अप्रैल-जून, 21	कोविड महामारी के कारण बैठक आयोजित नहीं हुई			१ सितंबर			१३ सितंबर			अधिकारी			कर्मचारी			अधिकारी			कर्मचारी			अधिकारी			कर्मचारी			विद्यमान			
जुलाई-सितंबर, 21	03.09.2021	07	16	03.09.2021	हिंदी पखवाड़ा और १४ सितंबर को हिंदी दिवस मनाया गया			अधिकारी			कर्मचारी			अधिकारी			कर्मचारी			अधिकारी			कर्मचारी			विद्यमान					
अक्टू-दिसंबर, 21	23/12/2021	06	19	23/12/2021	अधिकारी			कर्मचारी			अधिकारी			कर्मचारी			अधिकारी			कर्मचारी			अधिकारी			कर्मचारी			विद्यमान		
जनवरी-मार्च, 21	29.03.2021	10	20	29/03/2022	अधिकारी			कर्मचारी			अधिकारी			कर्मचारी			अधिकारी			कर्मचारी			अधिकारी			कर्मचारी			विद्यमान		

PUBLICATIONS OF THE INSTITUTE (2021-22)

LIST OF SCIENTIFIC PUBLICATIONS: (with Impact factor/ NAAS rating)

- 1) Devi, V., Atique, M.M., Raju, A., Upreti, G., **Jigyasu, D.K.**, Yadav, J.K., Singh, S., Kar, R., Singh, M. (2021). Mercury transportation dynamics in the Ganga Alluvial Plain, India: rainwater–groundwater–river water interaction study from hotspot region. *International Journal of Environmental Science and Technology* <https://doi.org/10.1007/s13762-021-03334-x> (IF=3.083; NAAS=8.86)
- 2) Gupta, A.K., Kumar, P., Rathore, A.C., Kumar, P., Kaushal, R., Islam, S., Yadav, D.D., **Jigyasu, D.K.**, Mehta, H. (2021). Soil and water conservation techniques based land degradation neutrality: a need-based solution for degraded lands in Indian perspective. *Current Science*, 121(10), 1343-1347. doi: 10.18520/cs/v121/i10/1343-1347. IF=1.102; NAAS=7.10)
- 3) Jalaja S. Kumar, Amit Kumar, Dharmender Kumar Jigyasu and **Aftab Ahmad Shabnam** (2021). Prioritizing Sericulture through Agroforestry intervention in North East India. *Accepted for publication in Indian Silk* under Article ID-DA00102.
- 4) Krishna Kumar Yadav, Santhana Krishnan, Neha Gupta, Shiv Prasad, Mohammed A. Amin, Marina M.S. Cabral-Pinto, Gulshan Kumar Sharma, Riadh Marzouki, Byong-Hun Jeon, Sandeep Kumar, Neeraja Singh, **Amit Kumar**, Shahabaldin Rezania, Saiful Islam (2022). A review on the evaluation of renewable bioenergy potential for sustainable development: Bright future in energy practice in India, *ACS Sustainable Chemistry & Engineering*, American Chemical Society. (IF =8.1; NAAS Score = 14.2)
- 5) **Kumar A**, Kumar A, Kumar M and Bhat JA (2022) Editorial: Greenhouse Gas Emissions and Terrestrial Ecosystems. *Front. Environ. Sci.* 10:834444. (IF =4.5; NAAS Score = 10.58)
- 6) Kumar, Amit; S.N., Vinodakumar; Tamuly, Borsha; Krishna, Gopal; Rai, Ashish; Shabnum, Aftab A.; Jigyasu, Dharmendra K.; Luikham, Reeta; Hazarika, Urmimala; Ahmed, Siddique A. (2021). Assessment of Nutritional Status of the Acidic Soils of Manipur Vanya Sericulture: Levels and Spatial Distributions, *Journal of Soil Salinity and Water Quality*, 13, 2, 204-213, 2021, *Indian Society of Soil Salinity and Water Quality*. (IF =NA; NAAS Score = 4.94)
- 7) **Mahesh, D.S.**, Arunkumar, K.P., Kumar, A., Shabnam, A.A., Luikham, R. and Vijayakumari, K.M. (2021). Leafhopper (*Empoasca flavescens* Fabricius): A Major Pest of Castor Affecting Sericulture in Northeast India. *Biological Forum – An International Journal*, 13(3): 617-620. (NAAS rating: 5.11).
- 8) **Mahesh, D.S.**, Doreswamy, C., Ramakrishna Naika, Chikkalingaiah, Subbarayappa, C. T. and Venkatesh, M. (2021), Impact of the various organic manures supplemented with standard package on soil properties for mulberry production in Chamarajanagar district under southern dry zone of Karnataka. *Biological forum- An International Journal*, 13(2):31-38. (NAAS rating: 5.11).
- 9) Malyan, S.K.; Singh, O.; Kumar, A.; Anand, G.; Singh, R.; Singh, S.; Yu, Z.; Kumar, J.; Fagodiya, R.K.; **Kumar, A.** (2022). Greenhouse Gases Trade-Off from Ponds: An Overview of Emission Process and Their Driving Factors. *Water*, 14, 970. (IF =3.1; NAAS Score =9.1)

- 10) Manickam, Jayakumar; Udayarpillai, Surendran; Pushpanathan, Raja; **Amit, Kumar**; Venkatramanan, Senapath (2021). A review of heavy metals accumulation pathways, sources and management in soils, *Arabian Journal of Geosciences*, 14, 2156, Springer. (IF =1.82; NAAS Score =7.83)
- 11) Marwein R, Singh S, Maharana J, Kumar S, **Arunkumar KP**, Velmurugan N and Chikkaputtaiah C (2021). Transcriptome-wide analysis of North-East Indian rice cultivars in response to *Bipolaris oryzae* infection revealed the importance of early response to the pathogen in suppressing the disease progression. *Gene*. 809:146049. doi: 10.1016/j.gene.2021.146049. (Impact factor: 3.68; NAAS Score =9.69)
- 12) Mondal Raju, K Madhurya, Prosanta Saha, Sanjib Chattopadhyay, Sreya Antony, **Amit Kumar**, Sovan Roy, Debraj Roy (2021). Expression profile, transcriptional and post-transcriptional regulation of genes involved in hydrogen sulphide metabolism connecting the balance between development and stress adaptation in plants: a data-mining bioinformatics approach. *Plant Biology*, 1, 23, Wiley. (IF =3.08; NAAS Score = 9.08)
- 13) Mondal, Raju; **Kumar, Amit**; Chattopadhyay, Sanjib Kumar (2021). Structural property, molecular regulation and functional diversity of Glutamine Synthetase in higher plants: a data-mining bioinformatics approach, *The Plant Journal*, 10.1111/tpj.15536, Wiley. (IF =6.41; NAAS Score =12.42)
- 14) Mondal, Raju; **Kumar, Amit**; **Shabnam, Aftab**; Chaturvedi, Ashish (2022). Elucidation of molecular and physiological mechanism addressing integrated omic approaches for heavy metal stress tolerance in crops, *Crop and Pasture Science*, *CSIRO PUBLISHING* (Accepted). (IF =2.3; NAAS Score = 8.3)
- 15) Prety R Narzary, Apurba Das, M Saikia, R Verma, S Sharma, P K Kaman, R C Boro, S Goswami, **D S Mahesh**, B Linggi, A Rajkhowa, J P Baruah. (2021). Recent trends in Seri-Biosciences: Its prospects in modern Sericulture. *The Pharma Innovation Journal*, 11(1): 604-611.(NAAS rating: 5.23).
- 16) Rajan R, Chunduri AR, Siripurapu P, Satti AB, Kottakota SK, Marupilla B, Arunkumar KP* and Mamillapalli A (2021) DFMO feeding lowers polyamine levels and causes developmental defects in the silkworm *Bombyx mori*. *Journal of Asia-Pacific Entomology* 25: 101835. (Impact factor: 1.303; NAAS Score =7.30)
- 17) Roy Dinata, Singh Subadas, Talukdar, S, Tamuly B, and Maji S. (2021). Studies on morphological character and polyphenism of *Melanitis leda* (Satyrinae: Nymphalidae) in Brahmaputra valley of Assam, India. *Ecology Environment and Conservation*. (NAAS: 6.45, IF 0.45).
- 18) Singh, P., Yadav, J.K., **Jigyasu, D.K.**, Singh, S., Kumar, N., Singh, I.B., Singh, M. (2021). Biotite as a geoindicator of rare earth element contamination in Gomati River Basin, Ganga Alluvial Plain, northern India. *Environmental Monitoring Assessment*, 193, 361. <https://doi.org/10.1007/s10661-021-09105-y> (IF=2.513; NAAS=8.513)
- 19) Srinivasaraghavan A, KPS Kushwaha, **Vijay N**, Shrishti Lingwal and Ram Niwas (2021). Status of legumoviruses infecting mungbean and urdbean in Tarai region of India. *The Pharma Innovation Journal*. SP-10(12): 188-194. (NAAS:5.23)

- 20) Srinivasaraghavan A., **N. Vijay** and Ram Niwas (2021) Evaluation Of Insecticides And Botanical Extracts For The Management Of Whitefly (*Bemisia Tabaci*) - Vector Of Yellow Mosaic Disease Of Urdbean. *J. Exp. Zool. India*. Vol. 24, No. 2, pp. 1835-1838. (**NAAS:5.25**)
- 21) Subadas Singh, T. James Keisa, DK Jigyasu, Reeta Luikham and Jalaja S. Kumar (2021) *Nesolynx thymus*: a biocontrol agent to control uzifly in muga ecosystem. *Indian Silk*, Vo 12 (old 60) No. 2, Pp. 17-19.
- 22) Subharani, S., Debaraj, Y and VijayaKumari, K.M. Impact of abiotic factors on the seasonal incidence of major insect pest of *Quercus serrata* Thunb., primary food plant of oak tasar silkworm, *Antheraea proylei* J. in Manipur, India. Accepted in *Annals of Plant Sciences*, (2022).
- 23) Subharani, S., Ponnuvel, K.M., Debaraj, Y and VijayaKumari, K.M. Sodium hypochlorite: A boon to protect oak tasar silkworms against tiger band disease, Accepted in *Indian Silk*, (2022).
- 24) T. James Keisa, Aftab Ahmad Shabnam, Vijay N and Palash Datta (2021). Resham Krishi Mela. *Indian Silk*, 11(59-5):41.
- 25) Thakur, Tarun Kumar; Patel, Digvesh Kumar; Thakur, Anita; Kumar, Anirudh; Bhat, Jahangeer A.; Bijalwan, Arvind; Kumar, Amit; Dobriyal, Manmohan; Kumar, Munesh; **Kumar, Amit** (2021). Biomass production assessment in a protected area of dry tropical forest ecosystem of India: A Field to satellite observation approach, *Frontiers in Environmental Science*, 10.3389/fenvs.2021.757976, Frontiers. (**IF =4.9; NAAS Score = 10.58**)
- 26) सूरज पाल, धर्मेन्द्र जिज्ञासुऔर जलजा एस कुमार (2021). उत्तर प्रदेश में एरी अनुसंधान विस्तार कार्यक्रम का प्रभाव. पदकपंद 'पसा', 11(59-5):44-46.

Books/ Book Chapters

1. **Kumar, A.**, Kumar, A., Bhat, J. A., Kumar, M., eds. (2022). Greenhouse Gas Emissions and Terrestrial Ecosystems. Lausanne: Frontiers Media SA. Pp: 1-113 (ISBN 978-2-88974-656-9).
2. Mina, Usha; **Kumar, Amit**; Chaturvedi, Ashish K.; Kumar, Pramod (2021); Climate Change and Plant Diversity: Threats and Opportunities Climate Change and the Microbiome, Sustenance of the Ecosphere, 10.1007/978-3-030-76863-8_20, 2021, Springer
3. Subrahmanyam G., Kumar A., Luikham R., Kumar J.S., Yadav A.N. (2021) Global Scenario of Soil Microbiome Research: Current Trends and Future Prospects. In: Yadav A.N. (eds) Soil Microbiomes for Sustainable Agriculture. Sustainable Development and Biodiversity, vol 27. Springer, Cham. https://doi.org/10.1007/978-3-030-73507-4_18

Booklets:

1. Jigyasu DK, Kumar A, Shabnam AA, Vijayakumari KM. (2022). Kesseru nursery raising techniques and management. CMERTI, CSB, Lahdoigarh, Jorhat Assam, Booklet (03): 1-12.

2. Mahesh D.S., Arun Kumar K.P. and K.M. Vijaya Kumari (2022). Eri Chawki Rearing Practices. CMERTI, CSB, Lahdoigarh, Jorhat Assam, Booklet (01): 1-37.
3. Subadas Singh, T. James Keisa, D.K. Jigyasu, Reeta Luikham, Vijayakumari K.M. (2022). Package of practices for Uzi fly Management in Muga ecosystem. CMERTI, CSB, Lahdoigarh, Jorhat Assam, Booklet (02): 1-22.

Technical Bulletin:

1. Jigyasu DK, Kumar A, Shabnam AA, Singh S, Vijayakumari KM. (2021). Ready reckoner for abatement of petroleum affects on Muga fields. CMERTI, CSB, Lahdoigarh, Jorhat Assam, *Bulletin* (02): 1-6.
2. Kumar A, Shabnam AA, Sangannavar P, Gogoi DK, Jigyasu DK, Vijayakumari KM. (2021). A ready reckoner for nutrient management in Som (*Persea bombycina*). CMERTI, CSB, Lahdoigarh, Jorhat Assam, *Bulletin* (01): 1-6.
3. Subadas Singh, Vijay N., D.K. Jigyasu, T. James Keisa, Reeta Luikham (2022). Solar ELD light traps- an efficient technology to control insect pests. CMERTI, CSB, Lahdoigarh, Jorhat Assam, *Bulletin* (03): 1-6.



GRANTS-IN-AID for the year 2021-22

Head	GIA RECEIVED	EXPENDITURE	SURRENDERED INCURRED
Plan Salary	142144244.00	142144244.00	0.00
NE- SC Salary	5425000.00	5425000.00	0.00
NE- ST Salary	16226598.00	16226598.00	0.00
Plan (NESalary)	32554158.00	32554158.00	0.00
Plan (General)	0.00	0.00	0.00
Plan (NE General)	17350000.00	17350000.00	0.00
Plan Capital	3500000.00	1050000.00	2450000.00
Plan (NE Capital)	2558000.00	2558000.00	0.00
Total	219758000.00	217308000.00	2450000.00

EXTERNAL FUND BALANCES FOR THE YEAR 2021-22

	DBT FUND	DST FUND
Opening Balance as on 01.04.2019-2020	3312975.00	1582982.00
Amount Received during the year	0.00	1400000.00
Expenditure during the year	650233.00	1027168.00
Surrendered during the year	107000.00	272638.00



Progress at a glance for the year 2021-2022

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)							Information, Education and Communication during	Soil Samples analyzed	No. of patents filed/granted and technologies to be commercialised	Revenue generated (Rs. in Lakhs)	
	Projects of earlier year continued through	Projects concluded during the year	New Projects initiated	No. of technologies validated	No. of trials covered	No. of technologies demonstrated	No. of locations covered	No. of stakeholders covered	No. of Programs Conducted	No. of stakeholders trained	Krishi Mela / Farmers meet	Farmers Field day	Awareness programme	Technology demonstration / Enlightenment programmes	Workshop / Seminars & Conferences	Field Visits	Other activities								
CMER&TI, Lahdoigarh	16	02	03				07	26	10	31	114	41	949	00	01	15	09	01	00	00	00	114	20	00	24.62
	Projects of earlier year continued through	Projects concluded during the year	New Projects initiated																						





C M E R & T

Central Muga Eri Research & Training Institute
Central Silk Board, Ministry of Textiles, Government of India
Lahdoigarh, Jorhat-785 700, Assam, INDIA