

*Annual Research and Administrative Report – 2014-15*

**वार्षिक अनुसंधान एवं  
प्रशासनिक प्रतिवेदन  
Annual Research &  
Administrative Report  
2014-15**



**केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान  
Central Sericultural Research & Training Institute  
केंद्रीय रेशम बोर्ड, वस्त्र मंत्रालय, भारत सरकार  
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## ***Annual Research and Administrative Report – 2014-15***

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**No of Copies: 120**

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डॉ एस निर्मल कुमार  
निदेशक  
उत्कृष्टता की ओर संस्थान  
को सशक्त करते हुए

रेशम कृषि के क्षेत्र में अग्रणी तथा वर्ष दर वर्ष अपने अनुसंधानात्मक एवं विकासात्मक कार्य क्षेत्रों में सर्वदा प्रगति के पथ पर अग्रसर “केन्द्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, बहरमपुर, पश्चिम बंगाल” के वर्ष 2014-15 की वार्षिक रिपोर्ट प्रस्तुत करना मेरे लिए परम सौभाग्य की बात है। यह संस्थान देश के पूर्वी और उत्तर पूर्वी क्षेत्रों के 13 राज्यों में राज्य सरकार के विभागों तथा हितधारकों के सम्मिलित विकास के लिए रेशम कृषि प्रौद्योगिकी और उत्पादक-सामग्री का उपयोग करने तथा उनकी योजना-प्रक्रियाओं और केंद्रीय योजनाओं के कार्यान्वयन को भी प्रभावी ढंग से बढ़ाने के लिए आवश्यक सेवा सहयोग प्रदान करते आ रहा है।

पश्चिम बंगाल में द्विप्रज उत्पादन लीक से हटकर दर्ज किया गया है। संस्थान का दृढ़ लक्ष्य दूर - दराज तक पहुँचना है। हम, उत्कृष्टता बनाए रखने के लिए अत्याधुनिक अनुसंधान और हितधारकों के साथ निरंतर विचार-विमर्श में संलिप्त रहते हैं। इन प्रक्रियाओं के माध्यम से, हम जटिल समस्याओं को पहले से भांपकर समय रहते समाधान करने में सक्षम हैं।

13 राज्यों में स्थित चार क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्र, 12 अनुसंधान विस्तार केन्द्र और 3 उप-अनुसंधान विस्तार केन्द्र अपनी स्थलाकृति और कृषि-जलवायु स्थितियों में विविधताओं के साथ इस संस्थान के विस्तार जाल-तंत्र (नेटवर्क) हैं।

मुझे यह रिकार्ड प्रस्तुत करते प्रसन्नता का बोध हो रहा है कि संस्थान के वैज्ञानिकों, अधिकारियों एवं कर्मचारियों के अथक प्रयासों और उत्कृष्ट कार्यों के फलस्वरूप आई एस ओ 9001:2008 मानक को कायम रखते हुए क्षेत्रों में रेशम कृषि के विकास में महत्वपूर्ण उपलब्धियाँ दर्ज करने में सफलता प्राप्त हुई है।

वर्ष के दौरान जारी 53 अनुसंधान परियोजनाओं/कार्यक्रमों/पायलट अध्ययन में से 21 परियोजनाओं/पायलट अध्ययन संपन्न करते हुए 33 परियोजनाएं प्रारंभ की गईं।



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उपलब्धिया: निम्न पोषकत्व मृदा के अंतर्गत 5.6 लाख टन / हेक्टेयर / फसल की सर्वोच्च पर्ण उपज के साथ एक नए शहतूत जीन प्रारूप विकसित किया गया है। एआईसीईएम (चरण-III) के अधीन एमवी-1 को पर्ण उपज में सर्वोत्कृष्ट पाया गया। शीघ्र अंकुरित और देर से जीर्णमाय शहतूत जर्मप्लाज्म सी 1540 और सी 1726 की पहचान नए जीन प्रारूप में ठंड सहिष्णुता के विकास में जनक के तौर पर उपयोग करने हेतु की गई। ग्लोबल वार्मिंग को ध्यान में रखते हुए उत्कृष्ट शहतूत के निरंतर अधि-उत्पादन के लिए पार्थिव कार्बन पृथक्करण पर किए गए अध्ययन के अंतर्गत यह पाया गया की हल्की जुताई के साथ घास आच्छादित जमीन में लगे (एस 1635) शहतूत पौधे चार फसलों में प्रति हेक्टेयर 4.48 से 5.87 मैट्रिक टन/वर्ष कार्बन (सीसीई) अभिग्रहण कर सकता है। बाढ़ प्रवण क्षेत्रों के लिए एक उपयुक्त शहतूत प्रजाति सी- 2028 को जारी किया गया है। शहतूत के मूल विगलन रोग के कारक जीव, (लकिओडिप्लोडिया थेओब्रोमाए: बोत्रोडिप्लोडिया थेओब्रोमाए) की पहचान करते हुए कवकनाशी की छिड़काव सारणी पर एक रेडी रिकॉनर उपलब्ध कराया गया है। जैव-प्रौद्योगिकी पहल से यह स्पष्ट है कि शहतूत में जीवाणुज पर्ण-चित्ती प्रतिरोध कम से कम तीन योज्य जीन के द्वारा नियंत्रित किया जाता है। शहतूत में पर्ण-चित्ती प्रतिरोध की पहचान करने के लिए आणविक टैग के रूप में संभाव्य गहन-विश्लेषण के लिए 2-3 एसएसआर आधारित ख्यात डीएनए मार्कर की पहचान की गई। पर्यावरण के अनुकूल कृषि प्रबंधन तथा कड़ी मजदूरी (इडजेरी) में कटौती के अंतर्गत एक फ्लोटपादक मशीन E<sup>3</sup> WM © SH/ PM का वैधीकरण प्रक्षेत्र में सफलतापूर्वक क्रियान्वित किया गया। इसके आतिरिक्त, शहतूत में सिंचाई जल के प्रभावी उपयोग और संरक्षण हेतु लागत प्रभावी ड्रम किट ड्रिप सिंचाई प्रणाली ((CoD<sup>2</sup>IS) को लोकप्रिय बनाया गया।

25 बहुप्रज और 34 द्विप्रज नस्लों के रेशमकीट जर्मप्लाज्म का संपोषण उनके मूल लक्षणों के अनुरूप किया गया। साथ ही, *Id* अवरोध वाहक नस्लों का उपयोग कर बहुप्रज (छद्मरंजित) M.Con.4<sup>ld</sup> और M.Con.4<sup>ld</sup> (गैर-छद्मरंजित) नस्लों का विकास अधिक कवच भार के साथ किया गया। रेशमकीट फसल संरक्षण उपायों पर जोर देते

हुए रेशमकीट फसलों में रोग प्रबंधन हेतु एक नए विस्तृत कमरा विसंक्रामक 'घर शोधन' का सूत्रीकरण किया गया और इसका वैधीकरण किया जा रहा है। SK6 x SK7 द्विप्रज आधार संकर का निष्पादन सभी क्षेत्रों और मौसमों में बेहतर पाया गया। इस क्षेत्र में द्विप्रज उत्पादन के लिए यह एक क्रांतिकारी नस्ल हो उठने के साथ ही इसे सभी हितधारकों द्वारा पूर्णतया अंगीकार कर लिया गया है। 8 राज्यों में पंद्रह (15) द्विप्रज समूहों के आयोजन के माध्यम से द्विप्रज उत्पादन संवर्धन कार्यक्रम के तहत द्विप्रज रेशम उत्पादन में 97.2 मैट्रिक टन की वृद्धि आरएफडी लक्ष्य 80 मैट्रिक टन की अपेक्षा दर्ज की गई।



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प्रौद्योगिकी हस्तांतरण के तहत , चार प्रौद्योगिकियों अर्थात प्रमुख शहतूत पीडकों के प्रबंधन के लिए वानस्पतिक कीटनाशकों का प्रयोग, श्वेत मक्खी प्रबंधन के लिए 0.015% थियामेथोक्सम (Thiamethoxam) का स्प्रे; वर्षाश्रित क्षेत्रों के लिए सल्फर (अमोनियम सल्फेट @ 40 किलो/हेक्टेयर/वर्ष) और KCl (1%) के पर्णाय स्प्रे द्वारा शहतूत उपज में सुधार को लोकप्रिय बनाया गया। प्रौद्योगिकियों के प्रसार हेतु विभिन्न विस्तार संचार कार्यक्रम आयोजित किए गए जिसमें 18,896 कृषकों/ रेशम -हितधारकों ने भाग लिया। अधीनस्थ क्षेत्रीय रेशम अनुसंधान केन्द्रों में की गई अनुसंधानात्मक व विकासात्मक पहल का प्रक्षेत्र तक प्रसार संबंधित क्षेत्रों में रेशम कृषि के विकास के लिए किया गया। इसके अलावे, संस्थान में विकासात्मक गतिविधियों के लिए एमजी-एनआरईजीए परियोजना क्रियान्वित की गई।

रेशम कृषि के अनवरत विकास के लिए स्टैकहोल्डरों तक तकनीकी ज्ञान का हस्तांतरण तथा उनमें क्षमता-निर्माण और आत्मविश्वास जगाने हेतु विविध मानव संसाधन कार्यक्रम आयोजित कर 958 व्यक्ति [पीजीडीएस: 44,एसयूपी:112, आईएसडीएस: 405, आवश्यकता आधारित: 397] प्रशिक्षित किए गए। इसके अतिरिक्त, उत्तर-पूर्व प्रशिक्षण कार्यक्रमके अंतर्गत 10 द्विप्रज क्लस्टरों से 1536 कृषकों/हितधारकों को प्रशिक्षण दिया गया।

कुल 20 शोध पत्र, 14 शोध लेखों, 38 न्यूज/रिपोर्ट, 18 पुस्तक/पुस्तिका/अध्याय और तकनीकी बुलेटिन/सार-संग्रह/विवरणिका/ पैम्फलेट/विस्तार-संहिता/लीफ्लेट्स प्रकाशित किए गए। शोध पत्रों का सारांश (राष्ट्रीय: 11; अंतराष्ट्रीय: 13) जर्नलों/सेमिनार/संगोष्ठी/सम्मेलन में प्रकाशित किए गए। साथ ही, संस्थान के नवीनतम अनुसंधान उपलब्धियों पर जागरूकता के लिए अर्धवार्षिकी आर. एंड डी. , न्यूज बुलेटिन 'न्यूज एंड व्यूज' का भी प्रकाशन किया गया।

राजभाषा हिंदी के प्रावधानों के कार्यान्वयन में अग्रणी भूमिका निभाते हुए संस्थान में आंतरिक राजभाषा कार्यान्वयन समिति (OLIC) की चार और नगर राजभाषा कार्यान्वयन समिति (TOLIC) की दो बैठकों का आयोजन किया गया। पूर्वी और उत्तर-पूर्वी राज्यों में राजभाषा के कार्यान्वयन के क्षेत्र में उत्कृष्ट योगदान के लिए पश्चिम बंगाल के माननीय राज्यपाल के कर-कमलों द्वारा तृतीय पुरस्कार से सम्मानित होने का सुअवसर इस संस्थान को प्राप्त हुआ है। साथ ही, नगर स्तर पर राजभाषा हिंदी के प्रसार में उल्लेखनीय योगदान के लिए राजभाषा संस्थान, नई दिल्ली द्वारा भी संस्थान को "कार्यालय दीप स्मृति चिह्न" से पुरस्कृत किया गया।

“कृतिमान शुभ संकेत है, तेजी से आगे बढ़ना शुरु किया है और तेजी से आगे बढ़ना है।”

*तिपू फ्याल*  
(डॉ एस निर्मल कुमार)  
निदेशक



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### FOREWORD



**Dr. S. Nirmal Kumar**  
**Director**

**Powering the Institute  
Ahead of Excellence**

It is my privilege to present the Annual report of the Central Sericulture Research and Training Institute, Berhampore, West Bengal for the year 2014-15. CSRTI, Berhampore a premier sericulture institute in the country is consistently improving its performance year after year. The Institute is assisting the state departments and stakeholders of 13 states in East and North East region of the country to use sericulture technology and inputs for their planning process and also to enhance the implementation of central schemes effectively to bring inclusive growth. The Bivoltine production in West Bengal has recorded a path breaking performance. The set mission of the institute is to reach the unreached. To maintain excellence, we engage cutting edge research and constantly interact with the stakeholders. Through these processes, we are able to foresee the complex problems and provide solutions ahead of time.

Four Regional Sericultural Research Stations, 12 RECs and 3 Sub-RECs located at 13 states are the extension network with variations in topography and agro-climatic conditions.

I am happy to place on record that the untiring efforts of scientists, officers and staff of this Institute has made to maintain the Institute as per ISO 9001:2008 through maintenance of quality work standards and many significant achievements in sericulture industry in the region.

During the year, 53 research projects / prog./ pilot studies were continued, 21 were concluded and 33 were initiated. The achievements are - one mulberry genotype developed with highest leaf yield of 5.6 mt/ha/crop under low nutrient soils. Under AICEM MV-1 recorded superiority in leaf yield. Identified two early sprouting and late senescent mulberry varieties C-1540 and C-1726 for utilizing as parents in developing cold tolerance genotypes. Addressing the global warming issues, experiment on terrestrial carbon sequestration for sustained high productivity with quality revealed Carbon Capturing Efficiency (CCE) of 4.48 to 5.87 mt for 4 crops from one hectare of mulberry under moderate tillage and grass cover. C-2028, a suitable mulberry variety for flood prone areas was released. Causal organism, *Laciodiplodia theobromae*: *Botryodiplodia theobromae*, root rot disease of mulberry was identified. A ready reckoner on spray schedule of fungicide was made available. Bio-technological intervention elucidated that bacterial leaf spot resistance in mulberry is controlled by at least three additive genes. Identified 2-3 SSR based putative DNA markers for possible in-depth analysis as molecular tags to identify BLS resistance in mulberry. For eco-friendly cultivation management, an efficient machine E<sup>3</sup> WM © SH/ PM has been successfully validated in the field under drudgery reduction. In addition, for effective use and conservation of irrigation water; cost effective Drum Kit Irrigation system (CoD<sup>2</sup>IS) has been popularized.



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Silkworm germplasm of 25 multivoltine and 34 bivoltine breeds were maintained true to their original characters. By using *Id* inhibitor carrier breeds, multivoltine M.Con.4<sup>1d</sup> (pseudo pigmented) and M.Con.4<sup>1d</sup> (non-pseudo pigmented) breeds with higher shell weight were developed. Crop protection measures for silkworm were stressed upon with formulation of a new broad spectrum room disinfectant 'Ghar Sodhan' which is under validation. SK6 x SK7 bivoltine foundation cross has performed well across the regions and seasons.

This has become a revolutionary breed for bivoltine production in this belt and well accepted by all the stakeholders. Bivoltine Production Promotion programme has been upheld through organizing fifteen (15) bivoltine clusters in 8 states and bivoltine silk production increased to 97.2 mt against RFD target of 80 mt.

Under Transfer of Technology, four technologies: use of botanical pesticides for management of major mulberry pests, spray of 0.015% Thiamethoxam for whitefly management; mulberry yield improvement through application of sulphur (ammonium sulphate @ 40 kg/ha/year) and foliar spray of

KCl (1%) for rain fed areas were popularised. Different extension communication prog. were organized for dissemination of technologies and 18896 farmers / seri-stakeholders participated. The R&D interventions made at nested Regional Stations were disseminated to the field for development of sericulture in the region. Implemented the MG-NREGA project at the Institute for developmental activities

For sustainable development of sericulture through transfer of technological knowledge to the stakeholders, capacity building and confidence gaining, various Human Resource Development programmes were organized and 958 persons were trained [PGDS: 44, SUP: 112, ISDS:405, Need based: 397]. In addition, under North-East Training prog., 1536 farmers/stakeholders from 10 Bivoltine Clusters were imparted training.

A total of 20 research papers, 14 research articles, 38 News / reports, 18 book/ booklet/ chapter and 34 technical bulletin/ compendium/ brochure/ pamphlet / extension manuals/ leaflets were published. Abstracts of research papers were published in National (11) and International (13) Journals/ presented in Seminars/ Symposium/ Conferences. Half-yearly R&D news bulletin "NEWS & VIEWS" for awareness on latest research findings of the Institute were also published.

Taken a lead role in promotion of Hindi and organized four Internal Official Language Implementation Committee (OLIC) meetings at the Institute and two Town-OLIC meetings were organized. The Institute was Awarded 3<sup>rd</sup> prize for outstanding contribution in Official language in Eastern and North-Eastern states and the prize was given by the Hon'ble Governor of West Bengal and also received Karyalaya Deep Smriti prize from Rajbhasha Sangathan, New Delhi.

**"Kirthiman accha sanketh hai.  
Tezise aage badna shuru kiya hai aur tez se aage badna hai."**



(Dr. S. Nirmal Kumar)  
Director



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### **1. EXECUTIVE SUMMARY**

During the period, 53 ongoing research projects / prog./ pilot studies (22 projects, 28 prog. and 3 pilot studies) were continued and 21 (5 projects + 12 prog.+ 4 pilot study) were concluded.

The brief highlights of Research and Developmental activities done for the year 2014-15 at CSR&TI, Berhampore and its nested units are as follows:

#### **MULBERRY IMPROVEMENT AND PRODUCTIVITY**

- Under evaluation of mulberry variety for low input soil in irrigated condition, out of 7 genotypes tested, C-9 showed highest leaf yield of 5.6 mt/ha/crop with 50% reduced dose of NPK (N:P:K::168:90:56 kg/ha/ year).
- Under AICEM (Phase-III), C-2038 was the best performer in both irrigated and rainfed conditions, while Tr-23 at RSRS, Kalimpong.
- Among 149 mulberry germplasm accessions screened to develop high yielding cold tolerant mulberry, C-1540 and C-1726 accessions were shortlisted as early sprouter (17-18 days) and late senescent (76-78 days) along with maximum leaf yield of 4.5 mt/ha and 4.2 mt/ha/crop respectively.
- “Terrestrial Carbon sequestration for sustained high productivity of quality mulberry” study, revealed maximum “Carbon Capturing Efficiency (CCE)” of 4.48 to 5.87 mt for 4 crops from one hectare of mulberry (S-1635) under moderate tillage with grass cover over the existing practices.
- C-2028, a water logged tolerant mulberry variety was released during Resham Krishi Mela at the Institute and also Majuli in Assam.
- Application of Geo-Spatial technology on mulberry has been initiated with North-Eastern Space Application Centre (NESAC), Shillong, Meghalaya.

#### **MULBERRY PROTECTION**

- Causal organisms of root rot (*Laciodiplodia theobromae* = *Botryodiplodia theobromae*) disease of mulberry in West Bengal was collected and identified from IARI, New Delhi and NFCCI, Pune, which is a first report.
- Calendar for application of fungicide was developed as a ready reckoner to control mulberry diseases and uploaded along with disease forewarning in the institute’s website [www.csrtiber.res.in](http://www.csrtiber.res.in).
- Bacterial leaf spot (BLS) resistance in mulberry was elucidated which is controlled by at least three additive genes. Identified 2-3 SSR based putative DNA
- markers for possible in-depth analysis as molecular tags to identify BLS resistance in mulberry.



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### **SILKWORM IMPROVEMENT AND PRODUCTIVITY**

- Under Post-Authorization Trail, Multi x Multi (284170 dfls), Multi x Bi (574200 dfls) and Bi x Bi (150300 dfls) of silkworm hybrids were tested and recorded significantly higher yield 30.78 kg in M.Con.1 x M.Con.4 in comparison to 29.3 kg in control, 51.04 kg in M.Con.4 x B.Con.4 in comparison to 44.7 kg in control and 50.3 kg/100 dfls in Gen3 x Gen2- in comparison to 47.6 kg / 100 dfls in control respectively.
- Twenty five multivoltine and thirty four bivoltine breeds were maintained true to their original characters during different rearing seasons.
- By using *Id* inhibitor carrier breeds, multivoltine breeds M.Con.4<sup>1d</sup> (pseudopigmeted) and M.Con.4<sup>1d</sup> (non-pseudopigmeted) with higher shell weight (0.222 to 0.238 gm) in comparison to 0.192 gm in control, were developed.

### **SILKWORM PROTECTION**

- To ensure better efficiency against various diseases, a new room disinfectant 'Ghar Sodhan' has been formulated and being field tested covering 283 farmers.

### **COST REDUCTION**

- An Efficient, Economic & Eco-friendly Weed Mower cum Shoot Harvest / Pruning Machine (E<sup>3</sup> WM © SH/PM) is being validated in the nested units.
- Irrigation water requirement @ 50% of ETc (12,44,500 litres ha<sup>-1</sup> crop<sup>-1</sup>) under micro-irrigation system has been taken up for popularization in the field for effective use and conservation of irrigation water; popularization of Cost Effective Drum Kit Irrigation system (CoD<sup>2</sup>IS) in the field is under progress.

### **TECHNOLOGY TRANSFER**

Under the Transfer of Technology prog., four technologies were popularized with a total of 1100 farmers.

- Popularization of botanical pesticides for management of major mulberry pests. Through this technology leaf yield loss was saved by 14.5% and tested with 100 farmers in 20 hectares
- Application of sulphur (Ammonium sulphate @ 40 kg/ha/year) fertilizer in mulberry. Yield response was 13.3%, tested with 168 farmers in 33.6 hectares.
- Foliar application of KCl (1%) in mulberry under rain fed condition. In moisture conservation with KCl (1%) spray, yield response was 5.3%, tested with 150 farmers in 30 hectares.
- Management of whitefly with 0.015% Thiamethoxam saved 18.6% leaf yield loss and tested with 250 farmers in 50 hectares.



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### **EXTENSION COMMUNICATION PROGRAMMES (ECP)**

- Under ECP, a total of 18896 persons / stakeholders were sensitized in different sericulture technologies.

### **HUMAN RESOURCE DEVELOPMENT (HRD)**

- Various Human Resource Development programmes were organized for Transfer of Technology for sustainable development of sericulture. A total of 958 persons were trained including 90 persons under North Eastern Region Textiles Promotion Scheme (NERTPS).
- Under North-East Training prog. 1536 sericulturists from 10 Bivoltine clusters were trained. Under Refresher training 161 state officers/ officials were trained.

### **PUBLICATION**

- A total of 20 research paper, 14 research articles, 38 News / reports, 18 book/booklet/chapter and 34 technical bulletin/ compendium/ brochure/ pamphlet / extension manuals/ leaflets were published.
- Abstract of 24 research papers (National: 11; International: 13) were published / presented in Seminars/ Symposium/ Conferences. Published Half-yearly R&D news bulletin “NEWS & VIEWS”.

### **OFFICIAL LANGUAGE IMPLEMENTATION**

- Received 3<sup>rd</sup> prize in Official language (Hindi) for outstanding contribution in Eastern and North-Eastern states, awarded by the Hon’ble Governor of West Bengal.
- Karyalaya Deep Smriti Chinha prize received from Rajbhasha Sangathan, New Delhi on 30<sup>th</sup> April, 2014 at Nainital for outstanding contribution in implementation of Official Language, at town level (TOLIC).

### **OTHER SIGNIFICANT ACHIEVEMENT**

- During the year Surveillance audit of ISO 9001: 2008 has been done and renewed the **ISO 9001: 2008 certificate** on 90.01.2015.

### **COLLABORATIVE RESEARCH PROJECTS**

- **PIB 3505:** Development of drought tolerant mulberry variety for rainfed sericulture. (Jan., 14 to Dec., 19) - CSGRC, Hosur
- **PPF 3532:** Assessment, development and management of area under mulberry in major sericulture districts of West Bengal. (Feb., 15 to Jan., 17) - NESAC, Meghalaya.



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- **AIE 3454:** Evaluation of elite bivoltine silkworm germplasm under different agro climatic conditions: All India Silkworm Germplasm Evaluation Programme Phase-II. [Networking collaborative project of CSGRC, Hosur] (Sept., 11 to Aug., 14).
- **APS 3497:** Studies on the environmental effect on P1 rearing, its' grainage performance followed by commercial rearing of silkworm *Bombyx mori* L., during unfavourable seasons of West Bengal. [in collaboration with NSSO] (May, 13 to Apr., 15).
- **B-KPG(P) 006:** Muga seed multiplication prog.: Raising of muga host plantation at RSRS-Annex, Kalimpong. (Nov., 09 to Mar., 15) - MSSO, Guahati.

### **BIVOLTINE CLUSTER PROMOTION PROGRAMME**

- Fifteen Bivoltine clusters at West Bengal (4), Odisha (2), Bihar (1), Assam (3), Manipur (2), Mizoram (1), Nagaland (1) and Tripura (1) have been successfully organized in 8 states under Eastern & North-Eastern and North Eastern zones.

### **ACHIEVEMENTS AT RSRSs**

- Three RSRSs, Koraput, Jorhat and Kalimpong were awarded with ISO 9001:2008 standard certificates on 04.09.2014, 08.11.2014 and 19.12.2014, respectively.
- At RSRS, Kalimpong, Tr-23 showed highest leaf yield of 10.6 mt/ha/yr. under AICEM (Phase III) Trial prog.
- A total of 690 muga seed DFLs were produced and supplied to DoT (Seri), West Bengal and MSSO Guwahati for multiplication.
- Under HRD programmes, 64, 278, 989 and 14 persons were trained at RSRS, Kalimpong, Koraput, Jorhat and Ranchi, respectively.
- Under technology dissemination prog., a total of 4895 farmers / seri-stakeholders were sensitized at RSRSs.
- Adoption of IVLP under ToT with 250 farmers at RSRS, Koraput registered mulberry leaf yield gain of 8.8 % over control (9.8 mt/ha/year).
- A combined volume of "Farmers Directory" covering 805 farmers of 8 clusters under Bivoltine Cluster Promotion Programme in North-Eastern states was published at RSRS, Jorhat.



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### **2. INTRODUCTION**

Central Sericultural Research Station at Berhampore established in 1943 has been certified as ISO 9001: 2008 Institute for rendering outstanding Research, Developmental, Technical, Technological, Extension and Service support to silk industry by developing package for mulberry management, silkworm rearing, innovations, products, processes suited to the Eastern and North Eastern regions comprising of 13 states, West Bengal, Odisha, Bihar, Jharkhand, Chhattisgarh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura and Arunachal Pradesh.

The Institute is having 63 acres of land, of which, mulberry plantation area is around 32 acres and it envisages its R&D and extension activities through seven major divisions namely Moriculture, Sericulture, Agronomy & Farm Management, Reeling & Spinning, Training, Project Monitoring, Coordination & Evaluation (PMCE) and Extension comprising of eleven research sections viz. Mulberry Breeding & Genetics, Agronomy, Soil Science & Chemistry, Farm management, Mulberry Physiology, Mulberry Pathology, Entomology, Silkworm Breeding & Genetics, Silkworm Physiology & Rearing Technology Innovations, Silkworm Pathology and Biotechnology besides Computer and Administration.

For dissemination of the developed technologies to the farmers and to get a regular feed back through its nested units, the Institute has an extension network of four Regional Sericultural Research Stations (RSRSs), 12 Research Extension Centres (RECs) and 3 REC sub-units located in different states.

#### **MANDATE:**

- ❖ Constant up-gradation of mulberry and silkworm productivity improvement for different agro-climatic zones.
- ❖ Testing centre for all mulberry silkworms' related experiments or feeding technologies evolved in CSB Institutions or referred by other agencies to CSB in the states identified for it.
- ❖ Human resources development through imparting training and capacity building.
- ❖ Constant dissemination of technologies evolved by the Institute at farmers' level for up gradation of yield for benefit of the farmers.
- ❖ Coordination with different state sericulture departments for development of sericulture industry in the Eastern and North-Eastern region.



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

Sl. No.	Objective	Action point / Success indicator	Target 2014-15	Achievement 2014-15	Achievt. (%)
1	Undertaking Research Projects to enhance quality and productivity	No. of Research Projects/ Prog. to be undertaken.	<b>15</b>	<b>37</b>	247 %
		No. of Projects to be concluded.	<b>5</b> (1 proj. + 3 Prog. + 1 Pilot Study)	<b>17</b> (1 proj. + 13 Prog. + 1 Pilot Study)	340%
		No. of New Research Projects/ Prog. to be taken up.	<b>8</b>	<b>8</b> (7 proj. + 1 Prog.)	100 %
2	Evaluation of improved varieties of mulberry and its dissemination to field.	Development of high yielding mulberry varieties	1	<b>1</b>	100%
		Absorption of the varieties in the field.	1	<b>2</b>	200%
3	Developing improved bivoltine / multivoltine breeds suitable to tropical regions and dissemination to field.	Development of improved bivoltine / multivoltine breeds.	1	<b>2</b>	200%
		Absorption of the breeds in the field.	2	<b>3</b>	150%
4	Integrated and Disease management and its dissemination to field.	Development of technologies / solutions.	2	<b>3</b>	150%
		Absorption of technologies / solutions.	1	<b>2</b>	200%
5	Food plant / silkworm race authorization programme.	Area covered in farmers' field for trial of new mulberry varieties.	50	<b>62</b>	124%
		Dfls proposed for field trials	2160	<b>2310</b>	107%
6	To extend the coverage of proven technologies to larger areas.	Stakeholders sensitized through Krishi melas, awareness & training prog.	2250	<b>2603</b>	116%
7	Adoption of sericulture villages / clusters under IVLP (Farmers covered).	No. of villages to be covered	8	<b>8</b>	100%
8		No. of farmers adopted	800	<b>1750</b>	219%
9		Expected rawsilk output (MT)	8.5	<b>14.92</b>	175%
10	New plantation with improved varieties	Popularization of Vishala, C-1730, Tr-23, C2028 and C2038 varieties (Acres)	45	<b>61.94</b>	138%
11	Identify the disease occurrence in advance & forewarn the beneficiaries with remedial measures.	Instances where such activities were undertaken.	14	<b>42</b>	300%
12	Implement ISO 9001 as per approved action plan.	Areas of operation covered	98	<b>100</b>	100%



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### 4. HIGHLIGHTS OF OUTPUT FROM THE CONCLUDED PROJECTS

#### 4. A. MAIN INSTITUTE

##### 4.A.1. PIP3469:

- Among 149 mulberry germplasm accessions studied, C-1540 and C-1726 were screened as early sprouting and late senescent accessions which were recommended as parents in breeding programme.

##### 4.A.2. AIP 3472:

- Amongst the bivoltine breeds, B.Con.4 and among multivoltine, M.Con.4 registered as thermo-tolerant along with the traditional breed Nistari (with low production potentiality). NB4D2 was found most susceptible amongst the bivoltines. Sarupat was also found severely affected with thermal stress > 32 °C. Effect of thermal stress including moulting period was severe in comparison to stress without moulting period.

##### 4.A.3. BPR(P)022:

- Bacterial leaf spot (BLS) resistance in mulberry is controlled by at least three additive genes. 2-3 SSRs based putative DNA markers were identified as molecular tags for BLS resistance in mulberry. BLS resistance transgressive progenies having higher yield potential than ruling cultivar were identified.

##### 4.A.4.BAR (PS)004:

- Seven combinations (1:1:1, 1:1:2, 1:2:2, 1:2:1, 2:2:1, 2:1:2 and 2:1:1) of proline, nicotinic acid and ascorbic acid ~ 20mg / ml were tested for synergistic effects against silkworm pathogens namely bacterial suspension, Nuclear polyhedrosis virus (*BmNPV*) and *Beauveria bassiana* causing common silkworm diseases.
- Most effective three immunogen formulations were shortlisted and tested on susceptible silkworm breeds namely S2, O, G and CB5 along with M6DP(C) showed increase of ERR (6%) and thereby increase of 4.8 kg cocoon yield.

##### 4.A.5.BAR(VP)009:

- A new room disinfectant '**Ghar Sodhan**' tested with 283 farmers showed effective against wide range of pathogens causing silkworm diseases. Benefit cost ratio is 3.42 over 5% bleaching powder solution.

##### 4.A.6.BAR (RP) 005:

- Crop wise survey of silkworm diseases covering 1253 farmers' in 189 villages in Murshidabad, Malda and Birbhum districts in West Bengal showed low disease incidence.

##### 4.A.7. BAI (RP) 006:

- A total of 1993 samples were examined covering 234 villages and DoS farms during parental seeds and commercial rearing in three traditional sericulture districts of West Bengal recorded low incidence of pebrine (0.06-3%) occurrence in seed and commercial seasons.



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### **4.A.8. AIE 3454:**

- Silkworm accessions BBE-268 (60), BBI-348 (57.8) and BBI-338 (56.9) showed higher evaluation index were potential parents for using in silkworm improvement.

### **4.A.9. AIB 3491:**

- Field testing of 2,84,170 dfls of Multi x Multi hybrids; 5,76,000 dfls of Multi x Bi hybrids, and 1,52,550 dfls of Bivoltine hybrids showed cocoon yield of 30.1 kg, 43.4 kg, and 36.5 kg /100 dfls, respectively. All the tested hybrids showed higher yields than the control hybrids.

### **4.A.10. BPP(P) 023:**

- Average of 1.35" (2489000 lrs. ha<sup>-1</sup> crop<sup>-1</sup>) and 1.08" (1991200 lrs. ha<sup>-1</sup> crop<sup>-1</sup>) per irrigation recorded as actual and optimum requirements of irrigation water respectively for mulberry crop in Gangetic alluvial soil was found effective in open furrow irrigation system under West Bengal conditions. Irrigation water equal to 50% of Evapo-transpiration (ETc) of the crop i.e., 1244500 lrs. ha<sup>-1</sup> crop<sup>-1</sup> found effective under micro-irrigation system.

### **4.A.11. BAI (P)0 29:**

- Genetic interaction between diapausing and *id* gene carrier in developed breeds and its effect on egg character conducted at RSRs, Kalimpong during spring season with Bi x M.Con.4 dfls showed 92-98% hatching and yielded 29.8 -54.8 kg cocoons/ 100 dfls.

### **4.A.12. BAR (P) 024:**

- Samples collected from silkworm larvae infested with Gattine showed presence of bacterial pathogen, *Staphylococcus vitulinus*. However, no virus was detected in the samples and can be inferred that the 'Gattine like' disease is caused by bacteria only.

### **4.A.13. BPP (VP) 015:**

- Designed and developed one **E3 WM © SH / PM**. Successfully validated and a total of 6 machines were developed for use at institute / RSRs. Efficiency & HRUE of the machine was weed mowing 21.6 hrs acre<sup>-1</sup> weeding<sup>-1</sup> with 14.81 HRUEI, shoot harvest 16.0 hrs acre<sup>-1</sup> harvest<sup>-1</sup> with 15.00 HRUEI and pruning 12.8 hrs acre<sup>-1</sup> pruning<sup>-1</sup> with 15.00 HRUEI.

## **4. B. REGIONAL SERICULTURAL RESEARCH STATION**

### **4.B.1. BKPG (P) 028:**

- Rearing of 3 multivoltine silkworm breeds, M.Con.1, M.Con.4 and M6DP(C) conducted during spring and summer seasons at RSRs, Kalimpong did not express diapause characters in any of the breeds.



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### **4.B.2.B-KPG(P) 006:**

- Established 3 acres muga food plantation at P-4 farm, muga seed crop produced and supplied to MSSO, State departments of West Bengal, Sikkim and Madhya Pradesh.

### **4.B.3. B-KPG (RP)010:**

- Low incidence of powdery mildew (3.7-5.1 PDI), brown leaf rust (1.1-5.5 PDI) and sporadic incidence of yellow leaf rust (0.1-1.1 PDI) during autumn crop; thrips incidence (0.3-0.6/leaf) and root mealy bugs during spring, while both mealy bug (0.8-4.5/plant) and leaf webber (1.7-3/plant) during summer and autumn were observed. In all the seasons, low incidence of Grasserie (0-5 %) was recorded at farmers level.

### **4.B.4. B-KPG(PS) 007 :**

- Leaf yield and biochemical analysis revealed  $6.9 \pm 0.71$  mt ha<sup>-1</sup> leaf yield during autumn in T<sub>2</sub> treatment i.e. application of NPK@150:50:50 kg ha<sup>-1</sup> + FYM @10 mt ha<sup>-1</sup> + potassium humate @25 kg ha<sup>-1</sup> followed by  $6.7 \pm 0.54$  mt ha<sup>-1</sup> in T<sub>3</sub> treatment i.e. application of NPK@150:50:50 kg ha<sup>-1</sup> + FYM @7.5 mt ha<sup>-1</sup> + Potassium humate@25 kg ha<sup>-1</sup> against the control (recommended)  $5.7 \pm 0.57$  mt ha<sup>-1</sup>.

### **4.B.5.B-KPT (RP) 013:**

- Incidence of two major mulberry foliar diseases namely brown leaf rust to the tune of 2.1 to 23.6 PDI and powdery mildew of 2.9 to 4.6 PDI were recorded at farmer's field under RSRS, Koraput.

**4.B.6.B-KPT(RP)014:** No incidence of diseases of mulberry silkworm observed.

### **4.B.7.MOE-3459:**

- Correlation study on socio-organization status i.e., educational status, occupation, age level, agricultural and sericultural land holding pattern, cosmopolitaness, social participation of farmers and cocoon and yield, revealed significant gaps between demonstration and farmers' plots.

### **4.B.8.B-JRH(PS)005:**

- Indigenous breed *C. nichii* of exotic origin showed highest survival and indigenous breeds Leimarel (local breed) showed highest yield and cocoon characters. Among improved breed, M12 (W) was highest yielder.



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### 5. AWARDS AND RECOGNITIONS



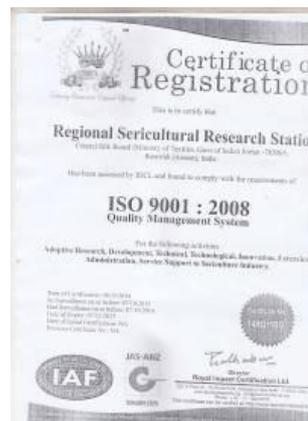
1. **Photo-1:** Best Educationist Award to Dr. S. Nirmal Kumar, Director by International Institute of Education & Management – for outstanding achievements in the field of Education (August, 2014).
2. **Photo-2:** Star Asia Award to Dr. S. Nirmal Kumar, Director by International Business Council – for outstanding achievements in the in the field of Education (September, 2014).
3. **Photo-3:** Appreciation to Director and Team, CSR&TI, Berhampore - by Delegates of Bangladesh Sericultural Development Board, Ministry of Textiles and Jute, Govt. of the People's Republic Bangladesh, Rajshahi on 29.11.2014.
4. **Photo-4:** 2<sup>nd</sup> Prize received on 6<sup>th</sup> Krishi O Baniya Mela, Chandipur, Math Chandipur, Agragami Handicapped Samity, Ratanpur, Debipur, Puirba Medinipur (6<sup>th</sup> to 15<sup>th</sup> December, 2014).
5. **Photo-5:** Appreciation to Director and Team, CSR&TI, Berhampore- by PHYSICON -2014 XXVI Annual National Conference of the Physiological Society of India (19<sup>th</sup> to 21<sup>st</sup> December, 2014)
6. **Photo-6:** Citation to Director and Team, CSR&TI, Berhampore- Recognition for successful implementation of Bivoltine Promotion Programme in West Bengal, 2014 by Director of Textiles (Sericulture), West Bengal on 29.12.2014.
7. **Photo-7:** 2<sup>nd</sup> Prize received on 19<sup>th</sup> Agricultural Industry-Tourism & Science festival, Baruipur, East Medinipur (6<sup>th</sup> to 12<sup>th</sup> January, 2015)
8. **Photo-8:** Prize-Karyalaya Deep Smriti Chinha received from Rajbhasha Sangathan, New Delhi on 30<sup>th</sup> April,2014 at Nainital for outstanding contribution in implementation of Official Language, Hindi at town level (TOLIC).
9. **Photo-9:** 3<sup>rd</sup> prize for outstanding contribution in Official language (Hindi) in Eastern and North-Eastern states, CSR&TI, Berhampore has been awarded by Shri Keshari Nath Tripathi, Hon'ble Governor of West Bengal.

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### ISO 9001-2008 standards:



CSR&TI, Berhampur has been continued with ISO 9001-2008 standards. The renewal of certificate granted on 9<sup>th</sup> January, 2015.



- Regional Sericultural Research Station, Koraput recognized as ISO 9001:2008 certified Sericulturist Research Station on 4<sup>th</sup> September, 2014.
- Regional Sericultural Research Station, Jorhat recognized as ISO 9001:2008 certified Sericulturist Research Station on 8<sup>th</sup> November, 2014.
- Regional Sericultural Research Station, Kalimpong recognized as ISO 9001:2008 certified Sericulturist Research Station on 19<sup>th</sup> December, 2014.



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### 6.A. TECHNOLOGIES TRANSFERRED AS COMPLETE PACKAGE UNDER IVLP – IV (ADARSHGRAM)

Technologies	Achievements
1. HY mulberry variety – S1635/S1/BC259(Hills)	S-1635 (1380 farmers; 276 Ha.) BC <sub>2</sub> 59 (100 farmers; 20 Ha.)
2. Spacing – 2' x 2' ( 3'x3')	S-1 (270 farmers; 54 Ha.)
3. Bio-fertilizer	<b><u>Irrigated condition</u></b>
a. Nitrofert: 20(10) kg/ha/yr in 5 split dose	<b>Leaf yield (mt/ha/yr)</b>
b. Phosphofert: 75 (40) kg/ha, once in 4 years	Control: 36.2; Treatment: 41.1 (yield gain 13.6 %)
4. Reduced dose of chemical fertilizer NPK 168:30:112 (75:10:50)	<b>Cocoon yield (kg/100 dfls)</b>
5. FYM /Vermicompost - 20 (10) mt/ha/yr	<b>M x M:</b> Control : 28.1; Treatment : 31.3 (yield gain 11.4%)
6. PGR – spraying twice @ 0.01 % after 15 & 30 days of pruning during <i>Aghrayani</i> and <i>Falguni</i> crops ( <i>spring &amp; autumn</i> )	<b>M x Bi :</b> Control : 40.5; Treatment : 45.9 (yield gain 13.2%)
7. Disinfection of rearing house with Sanitech	<b><u>Rainfed condition</u></b>
8. Improved MxB / BxB hybrids	<b>Leaf yield (mt/ha/yr)</b>
9. Labex as bed disinfectant	Control: 10.5; Treatment: 11.9 (yield gain 13.4 %)
10. Sampoorna for uniform ripening	<b>Cocoon yield (kg/100 dfls)</b>
11. Integrated nutrient management	<b>M x Bi :</b> Control 34.7; Treatment: 39.6 (yield gain 14.2%)
12. Integrated disease and pest management	<b>Bi x Bi :</b> Control : 36.; Treatment : 41.1 (yield gain : 13.9 %)

### 6. B.TRANSFER OF TECHNOLOGY:

#### I. Implementation of IVLP -IV (Adarshgram):

IVLP (phase-IV)- *Adarshgram* is being implemented in a cluster mode, through 8 clusters namely Berhampore, Khargram, Kaliachak, Bangalgram, Kalimpong, Ranchi, Koraput and Jorhat involving 1750 farmers. The Stakeholders were motivated to adopt technology package. Continuous supervision of mulberry plantation, rearing, timely supply of dfls and inputs to the farmers were done for 100% adoption of technologies.

#### **Irrigated conditions:**

Five crops namely Baisakhi, Jaistha/ Shravani, Bhaduri/ Aswina, Agraphayani and Falguni were undertaken by 620 beneficiaries of Berhampore, Khargram, Kaliachak and Bangalgram clusters and mulberry leaf yield of 41.2 mt/ha/yr against initial yield of 36.2 mt with 13.6 % gain over control was recorded.



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Against the rearing target of 63500 Multi x Multi dfls, 78325 dfls were reared and in Multi x Bi, 179000 dfls were reared against the target of 127000 dfls with the cocoon yield of 31.4 kg/ 100 dfls (Multi x Multi) against the initial yield of 28.1 kg with 11.4% gain. In Multi x Bi, cocoon yield was 45.9 kg/100 dfls with 13.2% gain over bench mark value of 40.6 kg/100 dfls.

Crop/ Season Parameters	Bais- hakhi	Jaistha/ Shravani	Bhaduri / Aswina		Agraha- yani	Falguni
Leaf yield (mt/ha/crop)	8.46	8.83	8.54		7.94	7.38
leaf yield (Initial)	7.29	8.05	7.52		6.82	6.55
<b>Gain %</b>	<b>16.0</b>	<b>9.60</b>	<b>13.50</b>		<b>16.40</b>	<b>12.60</b>
Target	-	-	<b>63,500</b>		<b>63,500</b>	<b>63,500</b>
Combination	M x B / MxM	M x M (NxM12W)	M x M (N x M12W)	M xB (PMxCSR2)	M x B N x (SK6xSK7)	M x B N x (SK6xSK7)
No. of Dfls	30000 (MxB) 4425 (MxM)	26400	29000	18500 (MxM) 33000 (MxB)	50500	65500
Cocoon yield	47.45	31.50	31.08	41.47	49.10	45.93
Cocoon yield (Initial)	42.63	28.38	27.90	37.65	43.55	40.58
<b>Gain %</b>	<b>11.3</b>	<b>10.8</b>	<b>11.4</b>	<b>10.1</b>	<b>12.7</b>	<b>13.2</b>

### Rainfed condition:

Three crops, Spring, Summer and Autumn rearing was done with 1130 beneficiaries under the Kalimpong, Ranchi, Koraput and Jorhat clusters. Mulberry leaf yield was 11.9 mt/ha/yr against the initial yield of 10.5 mt with 13.4% gain. In Bi x Bi, cocoon yield was 41.2 kg/100 dfls with 13.9% gain over the initial yield of 36.2 kg/ 100 dfls. In Multi x Bi, cocoon yield was 39.7 kg/100 dfls initial yield of 34.7 kg with 14.2% gain over control.

Crop/Season	Spring		Summer		Autumn	
Leaf yield (mt/ha/crop)	4.48		3.93		3.52	
Leaf yield (initial)	3.85		3.57		3.10	
<b>Gain %</b>	<b>16.30</b>		<b>10.10</b>		<b>13.50</b>	
Target	15000	25000	15000	13000	10000	25000
Combination	M x B	B x B	M x B	B x B	M x B	B x B
No. of Dfls	20383	20000	24732	17500	5850	36093
Cocoon yield	41.16	40.72	39.17	41.39	38.73	41.45
Cocoon yield (initial)	35.65	35.15	34.26	36.2	34.31	37.12
<b>Gain %</b>	<b>15.4</b>	<b>15.8</b>	<b>14.3</b>	<b>14.3</b>	<b>12.8</b>	<b>11.7</b>



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### II. Mulberry Productivity Improvement:

- a. Sulphur fertilizer application technology for augmentation of productivity was popularized among 168 farmers in the irrigated zone. Sulphur fertilizer was applied for targeted yield of mulberry in the form of ammonium sulphate @ 40 kg / ha/ year. Yield response in term of productivity was recorded and ranged between 7.9 and 9 mt/ha/yr with 13.3% gain over control (7.4 mt/ha/yr).
- b. Foliar application of 1% KCl was popularised among 150 farmers in rainfed zones of Jharkhand, Odisha and West Bengal and mulberry leaf yield response was ranging between 3.3 and 8% with increasing plant water status by 4.9%.

### III. Mulberry crop protection:

- a. Botanical pesticides for management of management of major mulberry pests was integrated with Yellow Sticky Traps during the incidence of whitefly was popularized with 250 farmers in West Bengal, Assam and Manipur. Botanical was tested with 100 famers in West Bengal. Pest population suppression was to the tune of 83.1%, resulting to reduction of 12.8% leaf yield loss.

	Control (Nos/ plant)	Treatment (Nos/ plant)	Suppression %	Leaf yield loss reduction (%)
Pest population suppression	12.1	2.04	83.1	12.8
Leaf Yield (mt <sup>-1</sup> ha <sup>-1</sup> yr)	36.6	41.30		

- b. Chemical control of whitefly with thiamethoxam was popularized with 250 farmers in the hot spot areas of West Bengal, Assam and Manipur. Pest population suppression was 82.6% thereby reducing leaf yield loss ranged between 10.4 and 13.6%.

## B. EXTENSION ACTIVITIES OF RSRS, REC AND REC (SU)

### I. REGIONAL SERICULTURAL RESEARCH STATIONS

Centre	BV seed cocoon generation (Yield: kg/100 dfls)	Authorization Trial of silkworm hybrids	Popu. of Silkworm hybrid under NE
RSRS, Kalimpong	SK6: 85 dfls; (65.4 kg) SK7:80 dfls; (64.1 kg). (10,162 dfls of SK6xSK7 produced and supplied).		
RSRS, Koraput	SK6 x SK7: 100 dfls (43.5 kg).	FC1xFC2, SK6xSK7 & BC4xBC1: 1010 dfls. (35.2, 43 & 23.5 kg)	
RSRS, Ranchi	SK6 x SK7: 50 dfls (30.3 kg).	Gen hybrid: 150 dfls. (42 kg)	



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RSRS, Jorhat	SK6 x SK7: 100 dfls (43.5 kg)	SK6 x SK7: 360 dfls; FC1 x FC2: 250 dfls; BCon4 x BCon1: 400 dfls (35.7, 35.2 & 23.5 kg)	40,000 dfls (SK6xSK7-17500 & FC1xFC2-22500) (44 & 34.6 kg). Farmers: 425
REC, Agartala	SK6 x SK7: 100 dfls (54.8 kg).	SK6 x SK7: 1000 dfls (55.2 kg).	50,225 dfls: PM x (SK6xSK7): 41,275 dfls PM x FC1: 8,950 dfls. (862 farmers) (43.9 & 40.1 kg)
REC, Aizwal	SK6 x SK7: 1000 dfls (46.1 kg).	SK6 x SK7: 1000 dfls (46.5 kg).	30,000 dfls; FC1xFC2: 15,000 dfls & SK6xSK7: 15,000 dfls.(200 farmers); (37.5 & 42.5 kg)
REC, Dimapur	SK6: 100 dfls (41.1 kg) SK7:100 dfls (46.1 kg). (1642 dfls of SK6xSK7 produced and supplied).	SLD 8 x SLD4: 500 dfls (27 kg); P5 x NB18 dfls (24 kg).	SK6 x SK7: 15,000 dfls, (150 farmers) (40 kg)
REC, Imphal	SK6: 75 dfls (46.2 kg) SK7:75 dfls (45.5 kg).	SK6 x SK7: 1000 dfls (45.6 kg).	31,500 dfls; CSR hyb.: 20,000 (46.7 kg); SK6xSK7-11,500 dfls (44.9 kg) (100 farmers)
REC, Shillong	SK6: 25 dfls; (43.2 kg); SK7:25 dfls; (44.1 kg). (10,043 dfls prepared).	SK6 x SK7: 1000 dfls (41.7 kg).	25,000 dfls; CSR2xCSR4: 12,500 dfls (53.7 kg); SK6xSK7: 12500 dfls (44.5 kg)
REC, Rangpo		SK6xSK7:500dfls (38.5 kg)	
REC, Deogarh	SK6xSK7: 3297 dfls (23.2; 30 kg - Agrahayani & Falguni).	1000 dfls: FC2xFC1: 500 dfls, (43.2 kg); BCon4xBCon1: 400 dfls (54 kg); SK6xSK7: 100 dfls. (44 kg)	
REC, Bademarenga	SK6 x SK7: 125 dfls (47.1 kg)	1000 dfls: FC2xFC1: 500 dfls, (40.4 kg); BCon4xBCon1: 500 dfls (25 kg).	
REC, Gumla		MCon4xBCon4: 300 dfls (25 kg); M6DPCx (SK6xSK7)- 400 dfls (18.5 kg); Nx (SK6xSK7): 100 dfls (9.2 kg)	



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REC (SU), Bhandra		740 dfls: MCon4 xBCon4: 240 dfls (18.3 kg); M6DPCx (SK6xSK7): 400 dfls (21 kg); Nx (SK6xSK7): 100 dfls (15.5 kg)	
REC, Mothabari		14000 M x B Dfls: N x (SK6 x SK7): 7000 dfls (45.2 kg);M6DPC x (SK6 x SK7): 7000 dfls (48.7 kg); 900 B x B Dfls; FC1 x FC2: 400 dfls (48.4 kg); BCon1 x BonC4: 400 dfls (51.7 kg); SK6 x SK7: 100 dfls (54.5 kg).	<b>17,900 dfls of M x B dfls:</b> MCon1 x BCon4: 7400 dfls (48.3 kg); MCon4 x BCon4: 7500 dfls (48.9 kg); N x NB4D2: 3000 dfls (44.9 kg) during Baishaki crop. During Bhaduri, 15000 dfls: MCon1x MCon4-10300 dfls (24 kg); N xMCon4: 1700 dfls (22.2 kg); N x M12W: 3000 dfls (22 kg)
REC, Kamnagar		<b>12,900 dfls:</b> M6DPC x (SK6xSK7): 5,700 dfls (52.7 kg); N x SK6xSK7): 6,300 dfls (55.7 kg); FC1xFC2: 900 dfls (53 kg). During favorable season BCon1xBCon4: 400 dfls (59 kg); SK6xSK7: 100 dfls (56.1 kg)	15,000 dfls: MCon1 x BCon4: 6,000 dfls, (49.4 kg) MCon4 x BCon4: 6,000 dfls (51.3 kg); NxNB4D2-3,000 dfls (41.6 kg). (150 farmers). Unfavorable season: 23,500 dfls, MCon1x MCon4: 10,200 dfls (34.8 kg); N x MCon4: 300 dfls (32.9 kg); NxM12W: 13,000 dfls (30.7 kg)
REC, MP Raj		2000 dfls: M6DPC x (SK6xSK7); Nx (SK6xSK7) & BCon1xBCon4 and SK6xSK7: 48.5; 45.3; 53.3 kg & 43.3 kg)	9000 dfls: MCon1x MonC4: 2000, Nx M12W-2000 dfls & MCon1xBCon4: 500 dfls, MCon4x BCon4: 500 dfls & NxNB4D2: 4000 dfls (37.5, 36.2 46.8, 52.5, 47.6 kg)
REC (SU), Rajmahal		5100 dfls: MxB-4000 & BxB -1100 dfls; (47.9; 54.8 kg)	Total 14000 dfls: MCon1xMCon4; 6DPC x (SK6xSK7); N x (SK6xSK7), BCon1xBCon4 and FC1xFC2: (28.4, 40, 45.6 and 54.8 kg)

**RSRS, Kalimpong:** Testing of new mulberry (Tr-23): 2000 saplings raised (55-60% survival), planted: 8'x 8'; **REC, Rangpo:** Survey & surveillance for mulberry & silkworm diseases: 20 farmers; **REC (SU), Bhandra :** Testing of mulberry (S-1635):10000 saplings raised (75-80% survival) & 2500 supplied.



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### **Extension Communication Programme and HRD and Expansion of improved mulberry varieties conducted by CSR&TI, Berhampore and nested units**

Centre	Extension Communication Programme								HR D No.	New area covered	
	R.K.M	Aware. prog.	Field day	Exhib	A.V. Prog.	Gr. Dis.	Tech. Demo	TTP / FTP		Area (ha)	Var.
CSRTI, B'pore	2 (1558)	5 (252)	1 (53)	7 (1918)	1 (61)	3 (73)	2 (57)	2 (147)	22	10.0	S-1635, Vishala
RSRS, Koraput	1 (110)	4 (94)	3 (134)	3 (134)	3 (134)	3 (73)	2 (54)	6 (123)	5	2.5	S-1635
RSRS, Ranchi	1 (120)	10 (903)	4 (104)	5 (605)	5 (605)	3 (68)	1 (13)	2 (26)	20	10	S-1635
RSRS, K'pong	1 (160)	4 (140)	1 (41)	1 (37)	1 (49)	2 (32)	2 (45)	3 (36)	10	3.0	BC259, TR-23
RSRS, Jorhat	1 (305)	3 (143)	2 (103)	3 (139)	3 (110)	3 (234)	2 (154)	2 (36)	5	2.5	S-1635
REC, Mothabari	-	5 (150)	5 (178)	4 (146)	5 (172)	8 (244)	2 (55)	5 (131)	12	4.0	S-1635
REC, Kamnagar	-	6 (285)	5 (196)	5 (238)	6 (255)	5 (239)	2 (80)	5 (206)	12	4.0	S-1635
REC, M.P.Raj	-	3 (150)	3 (189)	3 (189)	3 (134)	3 (108)	2 (68)	3 (155)	20	2.5	S-1635
REC(SU), Rajmahal	-	4 (385)	2 (276)	1 (150)	2 (129)	2 (268)	2 (152)	4 (361)	-	-	-
REC, Gumla	-	3 (97)	3 (104)	3 (103)	3 (101)	3 (100)	2 (68)	5 (182)	5	2.5	S-1635
REC, Deogarh	-	3 (105)	3 (160)	3 (160)	3 (160)	3 (79)	2 (66)	5 (167)	5	2.5	S-1635
REC, Bade-maranga	-	3 (92)	3 (92)	3 (92)	3 (92)	3 (81)	2 (44)	5 (115)	5	2.5	S-1635
REC, Rangpo	-	3 (108)	3 (118)	3 (90)	3 (88)	3 (118)	2 (82)	3 (86)	5	2.5	BC259
REC, Aizwal	-	3 (97)	3 (105)	3 (105)	3 (106)	3 (117)	2 (57)	5 (168)	5	2.5	S-1635
REC, Agartala	-	3 (61)	3 (59)	3 (86)	3 (72)	3 (274)	2 (21)	5 (122)	5	2.5	S-1635
REC, Shillong	-	3 (139)	2 (129)	3 (153)	2 (126)	3 (81)	2 (40)	5 (251)	5	2.5	S-1635
REC, Imphal		4 (148)	4 (96)	3 (65)	3 (74)	3 (80)	2 (67)	5 (146)	5	2.5	S-1635
REC, Dimapur		3 (95)	3 (107)	3 (97)	3 (95)	3 (97)	2 (60)	5 (140)	5	2.5	S-1635
REC(SU), Bhandra	-	3 (147)	1 (52)	2 (84)	-	4 (159)	2 (68)	5 (201)	5	2.5	S-1635



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Details of supply of cuttings / saplings, farm rearing and income.

Name of the nested units	Supply of mulberry		Farm/Farmers' rearing		Income (Rs.)
	Saplings (No.)	Cuttings (mt)	Dfls reared (No.)	Cocoons prod. /100 dfls (kg)	
<b>RSRSs</b>					
CSR&TI	11000	1.0			
Kalimpong	-	0.13	165	65.36 / 64.13	85236
Koraput	20000		100	43.30	42213
Ranchi	-	-	50	30.28	7667
Jorhat	-	-	100	43.5	331932
<b>RECs</b>					
Mothabari	-	3.6	-	-	11370
Kamnagar	45000	-	-	-	84000
Rangpo		-	-	-	-
Deogarh		-	3297	23.16 / 30.0	-
Bademaranga	--	-	125	47.07	4004
M.P.Raj			-	-	
Gumla	3000		-	-	17275
Aizwal		-	1000	46.10	-
Agartala		-	100	54.80	12855
Shillong		-	50	43.25/ 44.12	35475
Imphal		-	150	46.25/ 45.50	38762
Dimapur		-	100	41.13/ 46.05	11600
<b>REC(SU)</b>					
Rajmahal		-	-	-	2951
Bhandra	10000	-	-	-	8532
<b>Total:</b>	<b>86,000</b>	<b>4.73</b>	<b>5237</b>	<b>44.625</b>	<b>6,93,872</b>

### FARMERS FIELD SCHOOL:

Centre	Prog.	Participant	Centre	Prog.	Participant
Ranchi	2	80	Deogarh	2	22
Jorhat	2	36	Rangpo	2	60
Kalimpong	5	69	Aizwal	4	162
Koraput	3	32	Imphal	8	143
Mothabari	10	194	Dimapur	4	40
Kamnagar	10	260	Shillong	4	20
Rajmahal	4	106	Agartala	2	15
M.P.Raj	8	226	Gumla	9	180
Bademaranga	8	152	CSR&TI, Berhampore	1	60
Bhandra	5	201			
<b>Total</b>				<b>93</b>	<b>2058</b>



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### 7. TECHNOLOGIES / PRODUCTS / PROCESSES RELEASED

Sl No.	Technology	Technology details	Application details	Stakeholder (No.)	Expected Benefits
1.	Popularization of botanical pesticides for the management of major mulberry pests.	Application of Neem oil on mulberry for the management of major mulberry pests.	Neem oil (1.50%) spray on mulberry leaf twice at 15 days interval, after 4 pm.	300	Saved leaf yield loss 14.5%. Generate higher income.
2.	Popularization of Thiamethoxam for whitefly management.	Spraying of Thiamethoxam on mulberry for management of whitefly.	Spray of Thiamethoxam @ 0.015% on mulberry leaf twice at 15 days interval, after 4 pm.	200	Saved 18.6% leaf yield loss. Generate higher income.
3.	Popularization of yellow sticky traps for the management of major mulberry pests.	Fixing of yellow sticky traps in the mulberry field.	Yellow polythene strips (3'x2') pasted with grease, fixed on 2 stands at 3' high in mulberry field.	200	Whitefly and other insects get fixed on the grease. Eco-friendly management.
4.	Technology for application of sulphur fertilizer in mulberry field.	Sulphur fertilizer in mulberry field in the form of ammonium sulphate.	Ammonium Sulphate) application @ 40 kg/ ha/year.	150	Better quality mulberry leaf production.
5.	Technology for foliar application of KCl in mulberry field under rainfed conditions.	Application of KCl (1%) – as antitranspirant.	1 <sup>st</sup> foliar appl. 20 days before brushing followed by 2 <sup>nd</sup> appl. after 10 days of 1 <sup>st</sup> spray.	150	Better quality leaf production and cocoons and more income.
6.	Popularization of intercropping technology.	Intercropping in the mulberry field with short term crops.	Short duration crops- toria, red amaranth, green gram and cow pea.	100	Additional income generation.

### 8. PATENTS GRANTED : NIL

### 9. TECHNOLOGY COMMERCIALIZED

1. Labex – a silkworm bed disinfectant.
2. Sericillin - a synergistic composition for disinfecting silkworm body and silkworm bed.
3. Morizyme – B, a plant growth regulator.



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### 10. LIST OF RESEARCH PROJECTS AND PROGRAMMES

Institute/ RSRS	Ongoing			Concluded			Total			Grand Total
	Proj.	PS	Prog.	Proj.	PS	Prog.	Proj.	PS	Prog.	
CSR&TI	21	1	21	4	2	8	25	3	29	57
RSRS	1	2	7	1	2	4	2	4	11	17
Total	22	3	28	5	4	12	27	7	40	74

#### 10.A. Ongoing : 53 Nos ( 22 Projects + 28 Prog.+ 3 Pilot Study)

Sl. No.	Code No.	Title	PI
<b>ENVIRONMENTAL CHALLENGES &amp; GLOBAL WARMING(Proj.-6; Prog.-3 &amp; P.S.-1)</b>			
1.	<b>PIB 3505</b>	Development of drought tolerant mulberry variety for rainfed sericulture. (Jan., 14 to Dec., 19) [Collaborative project with CSGRC, Hosur]	M.K.Ghosh, Sci-D
2.	<b>PIB 3424</b>	Development of cold tolerant mulberry genotypes for sub-tropical plains. (Jan., 09 to Dec., 15)	M. K. Ghosh, Sci-D
3.	<b>PPF 3532</b>	Assessment, Development and Management of area under mulberry in major sericulture districts of West Bengal. (Feb., 15 to Jan., 17) [Collaborative with NESAC, Meghalaya]	M. Chaudhuri, Sci-D
4.	<b>BPP(PS) 008</b>	Evolving Growing degree day based integrated sericulture crop calendar. (Jun., 14 to May, 15)	M. Chaudhuri, Sci-D
5.	<b>BPP(VP) 012</b>	Real time spatio temporal validation trial for mulberry yield weather model. (Jun., 14 to Aug., 16)	M.Chaudhuri, Sci-D
6.	<b>BPI(P) 033</b>	Screening of mulberry seedlings for phenotypic plasticity of thermo- tolerance. (Dec.,14 to Mar.,17)	M.Chaudhuri, Sci-D
7.	<b>PPS 3452</b>	Terrestrial carbon sequestration for sustained high productivity of quality mulberry.(Jul.,11 to Jun.,15)	R. Kar, Sci-D
8.	<b>BPI(P) 026</b>	Popularization of water logged tolerant mulberry variety C-2028. (Feb.,14 to Jan.,17)	P.K.Tewary, Sci-D
9.	<b>AIB 3466</b>	Development of region specific bivoltine breeds suitable for highly fluctuating and seasonally variable climatic conditions of Eastern and North-Eastern India. (Aug., 11 to Dec., 16)	N.Suresh Kumar, Sci-D
10.	<b>AIB 3496</b>	Development of high temperature and high humidity tolerant bivoltine breeds of silkworm ( <i>Bombyx mori</i> L. ( Jun., 12 to May, 15)	N.Suresh Kumar, Sci-D
<b>INPUT COST REDUCTION(Project-2; Prog.-6)</b>			
11.	<b>PIB 3479</b>	Development of high yielding mulberry varieties using physiological growth parameters as markers for selection. (Oct., 12 to Sept., 16)	Jalaja S. Kumar, Sci-D
12.	<b>PIB 3515</b>	Evaluation of new developed triploid mulberry varieties for productivity and quality. (Jun., 14 to Mar., 2017)	P.K. Ghosh, Sci-D



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Sl. No.	Code No.	Title	PI
13.	<b>BPP (P) 027</b>	Studies on improvement of mulberry productivity through foliar supplementation. (Jul., 14 to Dec., 16).	S. Roy Chowdhuri, Sci-D
14.	<b>BPP (P) 035</b>	Integrated effect of certain proven technologies for crop productivity improvement and cost reduction in mulberry cultivation under West Bengal condition. (Sept., 14 to Aug., 16)	S. Roy Chowdhuri, Sci-D
15.	<b>BPP (VP) 010</b>	Multilocational validation trial for application of cationic micronutrients.	R. Kar, Sci-D
16.	<b>BPP (P) 020</b>	Evaluation of soil fertility for sustained production of quality mulberry leaf in Eastern India under long-term fertilization. (Jul., 05 to Jun., 10; Extn. up to Dec., 15)	R. Kar, Sci-D
17.	<b>BPA (P) 039</b>	Popularization of CoD <sup>2</sup> IS [Cost-effective Drum-kit Drip Irrigation System. (Dec., 14 to Nov., 15)	S. Rajaram, Sci-D
18.	<b>BAI (VP) 014</b>	Field level testing of the efficacy of surface active agent & wetting agent for the improvement of reelability of cocoon during adverse & favorable climatic seasons. (Jul., 14 to Dec., 15)	N. B. Kar, Sci-D
<b>ECO FRIENDLY &amp; ORGANIC FARMING (Project-3; Prog.-3)</b>			
19.	<b>PPE 3517</b>	Population Interaction of Pest and natural enemies in mulberry ecosystem. (Aug., 14 to Jul., 17) [*Collaborative with NBAIR, ICAR, Bangalore]	N. Lalitha, Sci-C
20.	<b>PRE 3508</b>	Studies on standardization of mass multiplication and field efficacy of <i>Scymnus pallidicollis</i> (Mulsant) for eco-friendly management of "Tukra". (Apr., 14 to Mar., 16)	M. V. Santha Kumar, Sci-D
21.	<b>ARP 3516</b>	Studies on symbiotic (Combination of probiotic and prebiotic) induction for control of common disease of silkworm, <i>Bombyx mori</i> L. (Oct., 14 to Sept., 16)	S. Chakraborty, Sci-C
22.	<b>BPP (P) 036</b>	Development of protocol for mulberry cultivation for organic silk: a new approach. (Sept., 14 to Aug., 19)	S. Rajaram, Sci-D
23.	<b>BPP (RP) 001</b>	Mother culture maintenance of <i>Azotobacter chroococcum</i> and Nitrofert mass production. [Micro project, (Continuous)]	S. Rajaram, Sci-D
24.	<b>BPP (RP) 002</b>	Mother culture maintenance of <i>Glomus mosae</i> [(Arbuscular mycorrhizal fungus (AMF)] and Phosphofert mass production. [Micro project (Continuous)]	S. Rajaram, Sci-D
<b>DRUDGERY REDUCTION &amp; WOMEN FRIENDLY TECHNOLOGIES (Prog.-1)</b>			
25.	<b>BPP (RP) 012</b>	Optimum resource utilization through vermiculture for generating on farm value added compost. (Jul., 14 to Jun., 15)	M. Chaudhuri, Sci-D



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Sl. No.	Code No.	Title	PI
<b>PRODUCTIVITY IMPROVEMENT(Project-7; Prog.-6)</b>			
26.	<b>PIB 3481</b>	Evaluation of mulberry varieties suitable for low in-put soils. (Jan., 13 to Dec., 17)	P.K.Ghosh, Sci-D
27.	<b>BPI (P) 025</b>	Maintenance of mulberry Germplasm Bank at CSR&TI, Berhampore (W.B.) (Continuous in nature, initially for 5 years) (Jan., 14 to Dec., 18)	M. K. Ghosh, Sci-D
28.	<b>AICEM (Ph-III)</b>	All India Coordinated Experimental Trail for Mulberry (AICEM)- Phase III, (A prog. of C.O., Bangalore) (Apr., 11 to Jun., 15)	M. K. Ghosh, Sci-D
29.	<b>PPA 3499</b>	Evaluation of field level performance of Vishala mulberry variety in different locations under irrigated conditions in West Bengal. (Apr., 13 to Mar., 18)	S.K.Mandal, Sci-D
30.	<b>BPP(P) 041</b>	Studies on quality status and leaf yield of short listed early sprouter and late senescence mulberry accessions. (Jan., 15 to Dec., 16)	P.K.Tewary, Sci.-D
31.	<b>AIB 3480</b>	Development of silkworm of silkworm ( <i>Bombyx mori</i> L) breeds from a gene pool with higher genetic plasticity. (Sept., 12 to Aug., 16)	G.K.Chattopa -dhyay, Sci-D
32.	<b>AIB 3501</b>	Development of high temperature and high humidity tolerant bivoltine breeds of silkworm ( <i>Bombyx mori</i> L.) breeds with high shell percentage and high neatness of silk filament. (Jul., 13 to Jun.,16)	A.K.Verma, Sci-D
33.	<b>AIB 3514</b>	Development of multivoltine based congenic /NIL breed of silkworm ( <i>Bombyx mori</i> L.) through introgression of “ <i>I d</i> ” gene and its uses. (Jun., 14 to May, 17)	A.K.Verma, Sci-D
34.	<b>AIB 3531</b>	Authorization trial of silkworm hybrids in Eastern and North-Eastern India. (Aug., 14 to Jul., 15)	A.K.Verma, Sci-D
35.	<b>BAI(RP) 003</b>	Maintenance of bivoltine and multivoltine germplasm and newly developed breeds and their lines. (Continuous in nature)	N.SureshKumar Sci.-D
36.	<b>APS 3497</b>	Studies on the environmental effect on P1 rearing, its graining performance followed by commercial rearing of silkworm <i>Bombyx mori</i> L., during unfavorable seasons of West Bengal. (May,13 to Apr., 15)	T.Datta (Biswas), Sci-D
37.	<b>BAR(VP) 013</b>	Validation cum refinement of open rearing house. (Jun., 14 to May, 15)	A.K. Saha, Sci-D
38.	<b>BMO(P) 032</b>	Institute Village Linkage Programme (Aug., 14 to July, 15)	D.Das, Sci-C
<b>DISEASE AND PEST MANAGEMENT (Project-3; Prog.-2)</b>			
39.	<b>CSS 2107</b>	Forewarning of Mulberry diseases of Eastern and North Eastern India. (Sept., 12 to Aug., 17)	S .K. Datta, Sci-D



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Sl. No.	Code No.	Title	PI
40.	<b>PPS 3504</b>	Study on root rot disease of mulberry in the Gangetic plains of West Bengal and development of its control measures. (Apr., 14 to Mar., 17)	S.K. Dutta, Sci.-D
41.	<b>BPI (P) 034</b>	Development, characterization and validation of expressed sequence tag derived microsatellite markers for mulberry <i>Morus</i> spp. (Sept., 14 to Aug., 17)	S.Chattopadhyay Sci.-D,
42.	<b>PIB 3521</b>	Assessment of promising powdery mildew resistance lines for perspective commercial use. (Jan., 15 to Dec., 17)	S.Chattopadhyay, Sci-D
43.	<b>BPR(P) 021</b>	Development of weather based forecasting models for mulberry pests. (Collaboration with 3 RSRs & 2 RECs) (Apr., 05 to Dec., 15)	S. K.Mukhopadhyay, Sci-D
<b>Regional Sericultural Research Station (Project-1; Prog.-8 &amp; P.S.-2)</b>			
44.	<b>B-KPG (PS) 006</b>	Diagnosis of nutrient constraints and its management in mulberry field at farms and farmers' level at Kalimpong hills. (Apr., 14 to Mar., 16)	R.L. Ram, Sci-C
45.	<b>B-KPG (VP)011</b>	Validation of test based doses of fertilizers and lime application in soils of Kalimpong hills to increase the yield and quality of mulberry ( <i>Morus spp.</i> ) leaf. (Apr., 14 to Mar., 16)	R.L. Ram, Sci-C
46.	<b>B-KPG (RP)008</b>	Maintenance of Bivoltine silkworm Germplasm. (Continuous in nature)	R. Bhutia (up to Jun., 14); C. Maji (fr. July, 14)
47.	<b>BKG(RP) 011</b>	Multiplication and supply of SK6 x SK7 dfls to Sikkim and plain area. (Apr., 2012 – continue)	C. Maji, Sci-D
48.	<b>BPP(P) 030</b>	Studies on high bush and tree type mulberry plantation under rainfed condition of Odisha. (Jun., 14 to Mar., 19)	Rushi Sahu, Sci-C
49.	<b>B-KPT (PS)009</b>	Effect of Irrigation scheduling on yield and water economy in mulberry by use of Hydro-gels –Poly acrylic acid based water insoluble polymers. (Jul., 14 to Jun., 16)	S. K. Misro, Sci-C
50.	<b>B-RNC (RP) 004</b>	Survey and Surveillance of disease and pest of mulberry and silkworm. (Continuous in nature)	M. Alam, Sci-C
51.	<b>B-RNC (P)031</b>	Screening and Identification of Bivoltine hybrids suitable for Jharkhand. (Jun., 14 to Feb., 17)	M. Alam, Sci-C
52.	<b>PRE 3511</b>	Studies on predatory efficacy of the coccinellid predator, <i>Scymnus posticalis</i> Sicard for management of white fly on mulberry. (Apr., 14 to Mar., 16)	Y.Deabraj, Sci-D
53.	<b>B-KPT (P)037</b>	Verification of predicted lime requirement for the acid soils of Koraput region under mulberry vegetation in Eastern ghat highland zone of Odisha. (Oct., 14 to Sept., 16)	S. K. Misro, Sci-C



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### 10. A. ONGOING RESEARCH PROJECTS & PROGRAMMES

#### 10.A.I. MAIN INSTITUTE

#### 10.A.I.1. ENVIRONMENTAL CHALLENGES & GLOBAL WARMING

#### 10.A.I.1.1. MULBERRY BREEDING AND GENETICS SECTION

#### 10.A.I.1.1.1. PIB 3424: Development of low temperature stress tolerant mulberry genotypes for sub-tropical plains. (Jan., 09 to Dec., 15).

M.K. Ghosh and P.K. Ghosh

**Objective:** Development of low temperature stress tolerant mulberry genotype capable of providing higher leaf yield during Aগ্রহায়ণী (Nov.) and ফাল্গুনী (Feb.) silkworm rearing seasons than the ruling variety, S-1635.

**S01: Hybridization, selection and preliminary screening of genotypes.**

**E 02: Primary screening of genotypes through Progeny Row Trial (PRT).**

Growth, yield and specific characters for low temperature tolerance were recorded during Feb., 15 crop. Highest leaf yield was in C-108 (15480 kg/ha/crop) followed by 9726 kg in C-384 and 9196 kg in C-212 as compared to 8721 kg in S-1635 (check). (Table-1)

**Table 1. Days to sprout, leaf yield, EC, NRA and other growth parameters of progenies (Season Feb., 15).**

Progeny No.	Days to sprout	Longest shoot length (cm)	Total shoot length (cm)	Leaf yield (kg/ha/crop)	EC (dS/m)	NRA ( $\mu\text{mol NO}_2^- \text{g}^{-1} \text{fr. wt.}$ )
29	9.75	114	702	7942	2.96	9.87
33	8.93	123	724	7601	3.03	10.22
39	8.75	104	686	6233	2.77	10.37
44	9.00	114	707	5571	3.55	10.88
45	8.88	128	834	8251	3.33	10.96
75	8.63	139	864	6316	3.43	10.32
108	8.00	207	1153	15481	3.59	12.47
193	10.25	141	934	8140	2.73	9.70
212	8.75	176	1065	9196	2.90	9.34
225	8.25	178	1008	8396	3.46	11.54
232	9.82	168	996	8959	2.85	9.72
294	10.12	96	647	5880	2.93	9.87
304	10.62	84	547	5288	2.95	10.24
371	9.75	119	749	8084	3.17	10.37
384	11.12	128	835	9726	2.89	10.68
S-1635 (check)	13.12	148	886	8722	2.30	9.87
CD at 5%	0.489	13.06	71.82	294.63	0.051	0.042



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### 10.A.I.1.2. FARM MANAGEMENT SECTION

#### 10.A.I.1.2.1. BPP (PS) 008: Evolving Growing Degree Day based Integrated Sericulture Crop Calendar. (Jun., 14 to May, 15).

M. Chaudhuri, G.K. Chattopadhyay and D. Chakravarty.

**Objectives:** Real time data generation for preparation of a calendar based on respective growing degree days of mulberry as well as silk worm phenology towards forecasting daily growth increment of silkworm and mulberry leaves as well as requirement of specific mulberry foliage under the spell of daily accumulated heat.

Study conducted on phenology of silkworm breeds viz. B.Con4, M.Con 4, SK6, SK7 and SK6 x SK7. Day of GDD to complete the larval period of SK6, SK7 and SK6x SK7 were:

Breed / hybrid	GDD ( <sup>o</sup> C Day)
SK7	396.6
SK6	397.5
SK6XSK7	398.7
MCon4	318.4
BCon4	318.4

#### 10.A.I.1.2.2.BPP (VP) 012: Real time spatio temporal validation trial for mulberry yield weather model. (Jun., 14 to Aug., 16).

M. Chaudhuri, G.B. Singh, Anukul Bara, G. S. Singh and B. K. Basumatary.

**Objectives:** To examine the validity of the model for mulberry yield prediction (PPF 3487) up to in-season level complementing silkworm rearing in different seri-ecozones and calibrate thereof the final model for optimum resource utilization.

Biofixing of selected S1635 for temporal observation on yield and agro-meteorology Dekadal observation of meteorological and leaf yield data were in progress. Moreover, records of temporal yield data on decadal scale and daily agro-meteorological data from 25<sup>th</sup> days after pruning (DAP) till 75<sup>th</sup> DAP and 30 DAP till 80 DAP were done. 2<sup>nd</sup> round of temporal observation were in progress.

### 10.A.I.1. 3. SOIL SCIENCE & CHEMISTRY SECTION

#### 10.A.I.1.3.1. BPP(VP) 010: Multilocational validation trial for application of cationic micronutrients. (Apr., 14 to Jun., 16).

R. Kar, S. Chatterjee, S. K. Misro, G. S. Singh, S. N. Gogoi, A. K. Dutta and T. Datta (Biswas).

**Objective:** To examine the validity of the technology for spraying of cationic micronutrients in mulberry garden.



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Critical cationic micronutrients for different zones of Eastern and North-Eastern India were diagnosed under the concluded project PPS 3435 entitled “Studies on micronutrients for sustained high productivity of quality mulberry in Eastern and North-Eastern India”. Spray schedule of the micronutrients for mulberry based on the critical level of their soil availability were derived under the said project. The validation aims at conducting field trial of the above-mentioned micronutrient-spray on mulberry growing at farmers’ level of different zones to evaluate the impact of technology in terms of mulberry productivity. Initially, soil samples were collected from farmers’ fields at different zones and analyzed to ascertain the status of availability of zone-wise critical micronutrients in comparison to the critical level of their soil availability. Based on the soil test value, spray of derived concentration of zone-wise critical micronutrient on mulberry were undertaken, where an encouraging response in mulberry leaf productivity was recorded (Table 2).

**Table 2. Effect of micronutrient-spray on mulberry leaf productivity.**

Farmers under the unit	Leaf yield (kg ha <sup>-1</sup> )		Response (%)
	Control	Treatment	
REC, Mothabari (0.22% Zn)	8408	9311	10.74
REC, Kamnagar (0.22% Zn)	7705	8421	9.29
RSRS, Kalimpong (0.10% Mn)	2646	2884	8.99
RSRS, Koraput (0.17% Zn)	3661	3860	5.44
REC, Bhandra (0.17% Zn)	2906	3105	6.85
RSRS, Jorhat (0.25% Zn)	4001	4346	8.62
RSRS, Jorhat (0.11% Cu)	3517	3803	8.13

### 10.A.I.1.3.2.PPS 3452: Terrestrial carbon sequestration for sustained high productivity of quality mulberry. (July, 11 to Jun., 15).

R. Kar

**Objective:** To enumerate the enhanced organic carbon stock of the soil due to the induction of altered farming practices in mulberry dim fit to carbon sequestration with comparison to existing one.

The experiment comprises six combinations of farming practices along with a fallow replicated thrice in a RBD. Mulberry variety S-1635, spaced at 60 cm x 60 cm were cultivated under different farming practices. Data pertaining to crop-harvest revealed significant variations in farming practices and seasons for productivity and carbon assimilation by mulberry (Table 3 and 4).

**Table 3. Season wise mulberry productivity under different farming practices.**

Farming practices	Leaf yield (mt ha <sup>-1</sup> ) in different seasons				Shoot yield (mt ha <sup>-1</sup> ) in different seasons			
	May	July	Sept.	Nov.	May	July	Sept.	Nov.
Intensive Tillage (IT)	7.91	9.15	9.16	6.33	4.19	5.15	8.27	2.06
IT + Grass	7.96	8.76	9.60	6.46	4.26	5.15	8.50	2.30
IT + Grass + Cover crop	6.66	7.56	8.47	6.10	3.36	4.14	6.96	2.28
Moderate Tillage (MT)	6.90	8.38	9.07	5.72	3.42	4.66	7.91	1.98
MT + Grass	8.29	9.16	9.81	6.85	4.46	5.57	8.75	2.45
MT + Grass + Cover crop	7.19	8.18	9.03	6.64	3.87	4.79	7.62	2.56
CD* farming practice	0.521				0.498			
CD* season	0.426				0.406			



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**Table 4. Season wise carbon assimilation by mulberry under different farming practices.**

Farming practices	Carbon assimilation by leaf (mt ha <sup>-1</sup> ) in different seasons				Carbon assimilation by shoot (mt ha <sup>-1</sup> ) in different seasons			
	May	July	Sept.	Nov.	May	July	Sept.	Nov.
Intensive Tillage (IT)	0.73	0.92	0.84	0.64	0.45	0.57	0.87	0.25
IT + Grass	0.76	0.83	0.88	0.66	0.45	0.54	0.87	0.26
IT + Grass + Cover crop	0.60	0.70	0.79	0.63	0.37	0.43	0.72	0.24
Moderate Tillage (MT)	0.68	0.79	0.85	0.60	0.38	0.50	0.86	0.23
MT + Grass	0.83	0.94	0.96	0.73	0.50	0.65	0.96	0.30
MT + Grass + Cover crop	0.67	0.81	0.80	0.67	0.42	0.52	0.78	0.29
CD* farming practice	0.056				0.054			
CD* season	0.045				0.044			

### 10.A.I.1.4. MULBERRY PHYSIOLOGY SECTION

#### 10.A.I.1.4.1. BPI(P)026: Popularization of water logged tolerant mulberry variety C-2028. (Feb., 14 to Jan., 17).

P. K. Tewary, M. K. Ghosh, A. K. Dutta, T. Datta (Biswas) and S. N. Gogoi.

**Objective:** To popularize C-2028 mulberry variety suitable for water logged area.

A total of 20,000 mulberry saplings of C-2028 were transplanted at farmer's field at Maguli and Lalitimukh villages of Assam and Malda and Murshidabad of West Bengal. Plants are under establishment stage and survivability was 79%.

### 10.A.I.1.5. SILKWORM BREEDING AND GENETICS SECTION

#### 10.A.I.1.5.1. AIB 3466: Development of region specific bivoltine breeds suitable for fluctuating and seasonally variable climatic conditions of Eastern and North-Eastern India. (Aug., 11 to Dec., 16).

N. Suresh Kumar, A. K. Saha, S. Chakraborty, S. Sreekumar and N. B. Kar.

**Objective:** To develop the bivoltine breeds with genetic potential to tolerate the adverse climatic conditions of Eastern, North Eastern and Uttar Pradesh regions.

Bivoltine silkworm breeds collected from different breeding centres were screened in ambient condition and maintained under congenial environment. Based

on overall performance especially the pupation, the breeds, GEN3, SK6, SK7, BHR2, BHR3, SK4C, D6PN, KSO1, DUN21, DUN22, KPGA, SK3C, MC4E, CSN, NB18, NB4D2, Chinese peanut and P5 were selected. By utilizing these selected breeds, foundation crosses (Oval x Oval and Dumbbell x Dumbbell) were made for initiating the breeding process. Based on overall performance 5 oval and 5 dumbbell breeding lines were shortlisted for further continuation. After rearing the breeding lines at the main institute, the breeding lines were shuttled to all the regional breeding centers. Performance of the breeding lines at the main Institute and all the regional centres are presented in Table 5-6.



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**Table 5. Performance of oval foundation crosses at the main institute.**

Sl. No.	Cross	Unit	Fecundity	Yield/10000 larvae (No.)	Yield/10000 larvae wt (kg)	Cocoon weight (g)	Shell wt (g)	Shell (%)	Cumulative EI
1	BHP1	BHB	533	9150	13.275	1.518	0.321	21.10	54.4
2	KAL1	KPG	542	9367	16.633	1.824	0.377	20.70	39.4
3	JORHAT1	JOR	584	7360	8.040	1.176	0.223	19.00	45.7
4	KORAPUT1	KPT	505	9615	14.351	1.469	0.299	20.50	48.3
5	BHANDRA1	BHAN	534	9080	14.451	1.578	0.322	20.40	44.9
6	SHILLONG1	SHIL	535	9500	14.251	1.690	0.270	16.20	52.1
7	BHP2	BHB	564	9167	12.003	1.499	0.326	21.70	51.6
8	KAL2	KPG	534	9567	15.866	1.686	0.294	17.40	55.4
9	JORHAT2	JOR	551	3480	4.480	1.136	0.212	18.70	59.4
10	KORAPUT2	KPT	534	9524	14.325	1.529	0.317	20.70	45.8
11	BHANDRA2	BHAN	528	9235	13.428	1.585	0.319	20.10	49.1
12	SHILLONG2	SHIL	528	9352	14.235	1.685	0.285	16.90	44.0
13	BHP3	BHB	484	9767	13.908	1.615	0.337	20.90	43.8
14	KAL3	KPG	537	8656	15.189	1.816	0.348	19.20	52.9
15	JORHAT3	JOR	548	6000	6.800	1.226	0.252	20.60	46.4
16	KORAPUT3	KPT	562	9067	14.238	1.461	0.274	18.80	56.2
17	BHANDRA3	BHAN	521	9157	14.534	1.595	0.316	19.80	52.0
18	SHILLONG3	SHIL	580	8387	13.234	1.650	0.270	16.60	56.3
19	BHP4	BHB	529	9400	13.589	1.516	0.327	21.60	47.7
20	KAL4	KPG	552	9422	15.722	1.705	0.310	18.20	51.6
21	JORHAT4	JOR	550	7880	8.800	1.110	0.251	22.60	44.4
22	KORAPUT4	KPT	565	9534	14.231	1.751	0.330	18.90	44.1
23	BHANDRA4	BHAN	532	9057	14.652	1.555	0.319	20.50	49.2
24	SHILLONG4	SHIL	574	9152	14.255	1.695	0.278	16.40	47.3
25	BHP5	BHB	572	9000	12.594	1.532	0.325	21.20	52.5
26	KAL5	KPG	568	9289	15.611	1.726	0.308	17.80	50.6
27	JORHAT5	JOR	560	3200	4.850	1.244	0.224	18.00	54.1
28	KORAPUT5	KPT	462	9432	14.625	1.451	0.258	17.80	55.5
29	BHANDRA5	BHAN	535	9125	13.765	1.565	0.313	20.00	54.8
30	SHILLONG5	SHIL	480	8010	14.825	1.730	0.280	16.40	50.2



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**Table 6. Performance of dumbbell foundation crosses at the main institute**

Sl. No.	Cross	Unit	Fecundity	Yield/10000 larvae (No.)	Yield/10000 larvae wt (kg)	Cocoon weight (g)	Shell wt (g)	Shell (%)	Cumulative EI
1	BHP6	BHB	494	9167	11.351	1.530	0.324	21.20	56.2
2	KAL6	KPG	521	9533	15.316	1.801	0.322	17.90	52.4
3	JORHAT6	JOR	590	6560	7.520	1.199	0.256	21.40	41.0
4	KORAPUT6	KPT	550	9715	14.320	1.455	0.346	23.78	42.8
5	BHANDRA6	BHAN	512	9002	12.451	1.525	0.307	20.10	51.1
6	SHILLONG6	SHIL	540	9187	14.520	1.670	0.280	16.50	45.9
7	BHP7	BHB	540	9567	13.912	1.509	0.328	21.70	41.8
8	KAL7	KPG	544	9622	15.589	1.946	0.349	17.90	42.0
9	JORHAT7	JOR	579	5800	6.320	1.206	0.231	19.20	53.1
10	KORAPUT7	KPT	545	9465	14.432	1.531	0.296	19.33	49.8
11	BHANDRA7	BHAN	505	9112	13.851	1.522	0.307	20.20	48.6
12	SHILLONG7	SHIL	530	9097	14.320	1.630	0.280	17.40	48.6
13	BHP8	BHB	434	9259	14.042	1.544	0.323	20.90	54.7
14	KAL8	KPG	525	9033	14.544	1.690	0.303	17.90	61.1
15	JORHAT8	JOR	577	5920	6.680	1.224	0.242	19.80	48.1
16	KORAPUT8	KPT	502	9286	13.880	1.502	0.313	20.84	57.6
17	BHANDRA8	BHAN	514	9115	14.115	1.515	0.295	19.50	53.5
18	SHILLONG8	SHIL	488	9377	13.680	1.650	0.270	16.60	56.3
19	BHP9	BHB	468	9200	12.088	1.582	0.328	20.70	51.5
20	KAL9	KPG	521	9467	16.400	1.790	0.317	17.70	52.1
21	JORHAT9	JOR	575	4040	4.480	1.211	0.235	19.40	57.8
22	KORAPUT9	KPT	515	9824	14.560	1.475	0.293	19.86	51.0
23	BHANDRA9	BHAN	505	9012	12.254	1.535	0.304	19.80	55.6
24	SHILLONG9	SHIL	498	9273	14.480	1.650	0.280	16.70	49.4
25	BHP10	BHB	545	9400	13.759	1.581	0.326	20.60	45.8
26	KAL10	KPG	515	9611	16.922	1.832	0.352	19.20	42.4
27	JORHAT10	JOR	525	6680	7.400	1.267	0.235	18.60	50.0
28	KORAPUT10	KPT	524	9738	14.425	1.426	0.323	22.65	48.7
29	BHANDRA10	BHAN	511	9214	13.257	1.542	0.310	20.10	41.2
30	SHILLONG10	SHIL	499	9397	13.400	1.670	0.280	16.60	49.8

### **10.A.I.1.5.2.AIB3496: Development of high temperature and high humidity tolerant bivoltine breeds of silkworm (*Bombyx mori* L). (Jul., 12 to Jun., 15).**

N. Suresh Kumar, G. K. Chattopadhyay and A. K. Saha.

**Objectives:** To determine the LD50 in silkworm. To develop a method of induction for thermal stress in silkworm. To develop high temperature and high humidity tolerant breed & biochemical characterization in relation to high temperature and high humidity stress.

Rearing of 10 bivoltine and 5 multivoltine breeds of the institute and 19 breeds (2 bivoltine and 17 multivoltine) of other Institutes designated as high-



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temperature tolerant were screened. The breeds were evaluated for high temperature and high humidity conditions of West Bengal showed highest survival in SK4C (90.4%) followed by SK7 (87.5%) and B.Con.4 (85.9%). Among the bivoltine breeds, BBE-178, B.Con.4, D6PN, SK7, SK4C, Dun-21 and ATR29 showed survival of 80% while, in multivoltine breeds MH1, BMI-027, BMI-025, Nistari and M.Con.4 showed survival of above 90%. The short-listed breeds were reared to identify the breeding resource material tolerant to high temperature and high humidity conditions. (Table 7 and 8).

**Table 7. Performance based selection of Bivoltine breeds at high temperature and high humidity.**

Sl. No.	Breed	Survival % (32±1°C and 85±5% RH)	Survival% (25±1°C and 65±5% RH)	Cumulative EI
1	ATR29	52.5	87.8	62.8
2	B.Con.1	67.4	91.4	40.5
3	B.Con.4	68.4	92.4	37.2
4	SK4C	63.2	91.1	45.1
5	SK7	55	92.5	49.6
6	SK6	56.7	91.1	51.2
7	Gen3	67.7	89.7	44.1
8	BHR3	61.7	87.5	54.8
9	BHR2	62.8	87.3	54.2
10	D6(P)N	58.4	86.4	60.5

**Table 8. Performance based selection of multivoltine breeds at high temperature and high humidity.**

Sl. No.	Breed	Survival% (32±1°C and 85±5% RH)	Survival% (25±1°C and 65±5% RH)	Cumulative EI
1	BMI-027	82.4	93.1	49.4
2	BMI-025	81.7	92.7	51.4
3	Nistari	82.7	95.8	41.8
4	M.Con.4	81.7	95.1	45.0
5	MH1	80.8	94.3	48.3
6	M.Con.1	82.6	94.8	44.6
7	M6DPC	81.5	94.1	47.9
8	M6M81	82.4	93.8	47.5
9	Cambodge	81.8	94.7	45.9
10	Sarupat	69.5	88.7	21.9

### 10.A.1.II. INPUT COST REDUCTION

#### 10.A.1.II.1. MULBERRY BREEDING AND GENETICS SECTION

**10.A.1.II.1.1.PIB 3479: Development of high yielding mulberry varieties using physiological growth parameters as markers for selection. (Oct., 12 to Sept., 16).**

Jalaja S. Kumar and P. K. Ghosh.



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**Objective:** To develop mulberry varieties with superior quality and with 10% higher leaf yield over existing ruling variety.

Out of total 1024 plants, data of yield contributing traits, total shoot length (TSL), number of branches and length of the longest shoot were recorded individually in 884 plants (Table.9).

**Table 9. Yield contributing traits, total shoot length (TSL), number of branches and length of the longest shoot.**

Parameter	Population Mean	Standard Deviation	No. of plants above Mean + 1 S.D.	No. of plants above Mean + 2 S.D.
Total Shoot Length (cm)	353.4	203.6	127	34
No of branch	4.49	1.83	118	25
Longest Shoot Length (cm)	88.7	24.41	132	23

### **10.A.1.II.1.2.PIB 3515: Evaluation of newly developed triploid mulberry varieties under irrigated condition. (Jun., 14 to Mar., 17).**

P.K. Ghosh, M.K. Ghosh, Jalaja S. Kumar, S.K. Dutta and N. Lalitha.

**Objective:** Evaluation of newly developed triploid mulberry varieties under irrigated condition for better productivity and quality.

A total of 15 triploids developed through conventional breeding programme *viz.*, C-105, C-252, C-77, C-135, C-333, C-47, C-57, C-109, C-116, C-124, C-129, C-131, C-138, C-174, C-448 were transplanted in the experimental plot in Simple Lattice Design with 4 replications. The plants were under establishment stage.

### **10.A.1.II.2 . AGRONOMY SECTION**

#### **10.A.1.II.2.1.BPP(P)027:Studies on improvement of mulberry productivity through foliar supplementation. (Jul., 14 to Dec., 16)**

S. Roy Chowdhuri, M.S.Rahaman (upto 30.09.2014) and S. Rajaram.

**Objective:** Increase of leaf productivity in S1635 mulberry through foliar supplementation.

Foliar supplementation of nutrients in mulberry cultivation was applied. Leaf harvest during Nov-Dec., 2014 revealed that T3 (20 mt FYM+NPK @336:180:112 kg/ha/yr + sulphur 0.32%) showed higher leaf yield, plant height and leaf area compared to other treatments. Plants were under establishment stage.

#### **10.A.1.II.2.2.BPP(P)35: Integrated effect of certain proven technologies for crop productivity improvement and cost reduction in mulberry cultivation under West Bengal condition. (Sept., 14 to Aug., 16).**

S. Roy Chowdhuri and S. Rajaram.



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**Objective:** Exploitation of integrated effect of certain proven technologies for productivity improvement and cost reduction in mulberry cultivation under West Bengal conditions.

Plantation raised under irrigated (60 cm x 60 cm) and rainfed 90 cm x 90 cm) conditions and were under establishment stage.

**10.A.1.II.2.3.BPP(P)039: Popularization of CoD<sup>2</sup>IS [Cost-effective Drum-kit Drip Irrigation System. (Dec., 14 to Nov., 15).**

S. Rajaram

**Objective:** Irrigation water conservation and savings & productivity improvement. Quality linked Productivity improvement at farmers' level.

Installations of CoD<sup>2</sup>IS at 4 RSRs were initiated.

### 10.A.1.II.3. SOIL SCIENCE & CHEMISTRY SECTION

**10.A.1.II.3.1.BPP(P)020: Evaluation of soil fertility for sustained production of quality mulberry leaf in Eastern India under long-term fertilization. (Jul., 10 to Jun., 15).**

R. Kar

**Objective:** To study the sustenance of mulberry productivity under long-term fertilization. Evaluation of soil fertility of mulberry gardens by the rational use of fertilizers and manures on long-term basis.

The study comprises three combinations of nutrient-inputs replicated thrice in a RBD. Mulberry varieties S-1635, spaced at 60 cm x 60 cm, were cultivated under different nutrient-inputs. Data pertaining to different crop-harvests revealed significant variations for nutrient-inputs and seasons with respect to productivity and NPK uptake by mulberry (Table 10 and Table 11). Besides, analysis of soil samples collected after eighth year of experimentation revealed that the performance of fertilizers application in conjunction with manure was better than only fertilizers as well as control in terms of soil fertility.

**Table 10. Season wise leaf yield and N uptake by mulberry under different nutrient-inputs.**

Treatment (kg ha <sup>-1</sup> year <sup>-1</sup> )	Leaf yield (mt ha <sup>-1</sup> ) in different seasons				N uptake (kg ha <sup>-1</sup> ) by mulberry in different seasons			
	May	July	Sept.	Nov.	May	July	Sept.	Nov.
No Nutrient	1.69	1.46	2.05	0.61	16.22	13.34	22.05	6.92
N <sub>336</sub> P <sub>180</sub> K <sub>112</sub>	4.87	6.50	7.27	3.84	44.48	65.27	75.96	35.61
N <sub>336</sub> P <sub>180</sub> K <sub>112</sub> +FYM <sub>20mt</sub>	8.12	8.90	9.00	6.66	78.40	92.60	95.15	62.38
CD* nutrient	0.416				3.86			
CD* season	0.480				4.45			
CD* nutrient x season	0.832				7.71			



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**Table 11. Season wise P and K uptake by mulberry under different nutrient-inputs**

Treatment (kg ha <sup>-1</sup> year <sup>-1</sup> )	P uptake (kg ha <sup>-1</sup> ) by mulberry in different seasons				K uptake (kg ha <sup>-1</sup> ) by mulberry in different seasons			
	May	July	Sept.	Nov.	May	July	Sept.	Nov.
No Nutrient	2.60	2.50	3.86	1.13	12.06	8.07	18.37	4.85
N <sub>336</sub> P <sub>180</sub> K <sub>112</sub>	5.52	7.30	10.96	6.36	27.99	35.30	55.77	25.12
N <sub>336</sub> P <sub>180</sub> K <sub>112</sub> +FYM <sub>20mt</sub>	9.46	11.27	12.90	8.78	48.03	50.84	68.05	38.91
CD* <sub>nutrient</sub>	0.56				2.51			
CD* <sub>season</sub>	0.65				2.90			
CD* <sub>nutrient x season</sub>	1.13				5.02			

### 10.A.1.II.4. REELING & SPINNING DIVISION

#### 10.A.1.II.4.1.BAI (VP) 014: Field level testing of the efficacy of surface active agent & wetting agent for the improvement of reelability of cocoons during adverse and favourable climatic seasons. (Jul., 14 to Dec., 15).

N. B. Kar, A. K. Saha, D. Chakravorty, A. K. Datta, M. K. Majumdar and S. Nirmal Kumar.

**Objective:** Effective and economic use of cocoons under stressed condition during adverse climatic seasons as well as favourable seasons. Recommend and suggest for the remedial measures for improvement in the reelability of cocoons as well as quality improvement of raw silk.

Treatment	AFL	NBFL	Denier	Reelability %
<b>1<sup>st</sup> crop : Season: June- July, 2014</b>				
<b>Race : N x M12W (Without treatment)</b>				
T1				45
T2	336	168	2.40	45
T3				50
Average				44
<b>Hybrid : N x M12W (With treatment)</b>				
T1				52
T2	342	176	2.39	56
T3				52
Average				<b>53.3</b>
<b>2<sup>nd</sup> crop : Aug.-Sept., 2014</b>				
<b>Race : M. Con.1 x M.Con.4 (Without treatment)</b>				
T1				38
T2	313	95	2.26	35
T3				36
Average				<b>36.3</b>
<b>Race : M. Con.1 x M.Con.4 (With treatment)</b>				
T1				45
T2	325	102	2.36	40
T3				44
Average				<b>43</b>



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<b>3<sup>rd</sup> crop : (Multi x Bi) for Nov.-Dec., 2014</b>				
<b>Race : M.Con.1 x B.Con.4 (Without treatment)</b>				
T1				75
T2	523	425	2.46	77
T3				71
<b>Average</b>				<b>74</b>
<b>Race : M.Con.1 x B.Con.4 (With treatment)</b>				
T1				80
T2	550	480	2.51	79
T3				83
<b>Average</b>				<b>80.6</b>
<b>3<sup>rd</sup> crop : (Bi x Bi) for Nov.-Dec., 2014</b>				
<b>Race : SK6 x SK7 (Without treatment)</b>				
T1				70
T2	523	425	2.46	75
T3				74
<b>Average</b>				<b>73</b>
<b>Race : SK6 x SK7 (With treatment)</b>				
T1				90
T2	550	480	2.51	86
T3				88
<b>Average</b>				<b>88</b>

**Treatments:** = 30 minutes steaming + 3-5 minutes boiling + soaking for 30 minutes @ 1ml/L Wetting Agent & 1g/L Surface Active Agent + reeling at 80<sup>o</sup> C, it has been fine tuned and quantum of SAA & WA have been increased to 5 g/L & 2ml /L respectively.

Cocoon procured during Shrivani (June-July), Bhaduri (Aug.-Sept), Agrahayani (Nov.-Dec.) were reeled at M/s Bhagirathi Silk Industry, Madhughat, Malda. Reeling data is presented on Table 22 -25. All the crop data corroborated with the findings of the the laboratory results. The cocoons were divided in two groups, 15 kg in each group. One group was reeled without any treatment and other group was reeled subjected with the treatment of recommended Surface Active Agent (SAA) and Wetting Agent (WA). Use of Surface Active Agent (SAA) and Wetting Agent (WA) in combination showed a range of 6.6 to 15% edge over the control. However, the laboratory experiments were fine tuned i.e. 2 ml /L of WA 5g /L SAA. Cocoons of Chaitra crop (Feb.-Mar.) were procured for reeling.

### **10.A.1.III. ECO FRIENDLY & ORGANIC FARMING**

#### **10.A.1.III.1. ENTOMOLOGY SECTION**

**10.A.1.III.1.1.PRE 3508: Studies on standardization of mass multiplication and field efficacy of *Scymnus pallidicollis* (Mulsant) for eco-friendly management of Tukra.** (April, 14 to March, 16).

N. Lalitha, M.V.Santha Kumar (up to 03.01.15) and A.K. Saha.

**Objective:** Study the intrinsic rate of increase of the native predator in ambient conditions. To standardize the mass multiplication technique of the native predator. To determine the optimum number of native predators that are required to be released per unit area.



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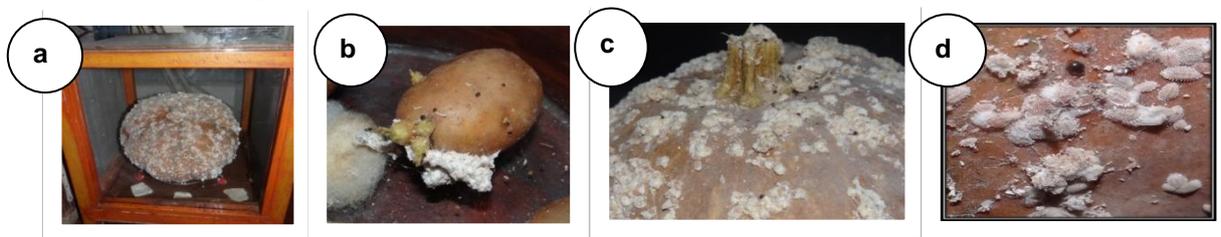
### **E01. Studies on the mass multiplication attributes of the native predator, *Scymnus pallidicollis*.**

- a) Maintenance of cultures of mealy bug its native predator.
- b) Life cycle and longevity study of the predator under ambient conditions.

Study of life cycle of the predator under ambient conditions revealed that life cycle was completed in 25- 29 days signifying the climatic influence on the biology. Prolonged life cycle was recorded during winter seasons. During May and June, the eggs were desiccated. The predators reared in the laboratory were vigorous, healthy with normal oviposition behaviours indicating the possibility of mass production of the native predator for augmentative biological control programmes.

### **E02. Studies on standardization of the mass multiplication of the native predator, *Scymnus pallidicollis*.**

To initiate and standardize the mealy bug/ host cultures studies were conducted on sweet pumpkin and potato sprouts. With the release of initial population of mealy bug on pumpkins with 100, 200 and 300 egg masses within a period of 30 days the host population multiplied to 11568, 14931 and 19480 respectively. The multiplication rate obtained during a period of thirty days was found satisfactory in the laboratory conditions and hence predators were released on the host population maintained on the two substrates pumpkin and potato sprouts. Mealy bug colonies multiplied on sweet pumpkin were exposed to 50,100,120,150, 160, 180 and 200 pairs of *Scymnus pallidicollis* in the oviposition cages (Fig.1.a) and kept for mass multiplication. In a period of one month, 180, 324, 462, 680, 748, 824 and 949 predators were harvested respectively. With the release of initial population of 10, 20 and 30 pairs of *S. pallidicollis* on the mealy bug infested sprouted potatoes (Fig.1.b), the population obtained after one month was 18, 35 and 54 respectively. For mass production of predators pumpkins are found to be more effective substrate for host multiplication as compared to potato sprouts due to higher surface area and availability of higher host density.



**Fig.1.** Mass multiplication of mealy bug and predators. a. Mealy bugs mass multiplied over sweet pumpkin and set in oviposition cage for predator multiplication. b. Potato sprouts with mealy bug colonies inducing egg laying by predators during mass production. c. Predators feeding on nymphs and adults of host insect d. enlarged view of predator and host insects on pumpkin.

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### 10.A.1.III.2.SILKWORM PATHOLOGY SECTION

**13.A.1.III.2.1.ARP 3516: Studies on synbiotics (combination of probiotic and prebiotic) induction for control of common diseases of silkworm *Bombyx mori* L.** (Jul., 14 to Jun., 16).

S. Chakrabarty and A.K.Saha.

**Objectives:** Application of synbiotics (combination of Probiotics and Prebiotics) for eco-friendly silkworm disease management. Strengthen the immunity of silkworm to resist the microbial pathogenic attack. To promote good cocoon yield.

*In vitro* cultures and subcultures of probiotics were under progress. *In vitro* screening / testing of Synbiotic preparation were initiated. Plate culture of probiotics and prebiotic were done (Fig. 2).



*Lactobacillus sporogenes*

*Clostridium butricum*

*Streptococcus faecalis*

*Lactobacillus acidophilus*

*Lactobacillus reuteri*

*Saccharomycis boulardii* (Prebiotic)

### 10.A.1.III.3. AGRONOMY SECTION

**10.A.1.III.3.1.BPP(P)36:Development of protocol for mulberry cultivation for organic silk : a new approach.** (Sept., 14 to Aug., 16).

S. Rajaram (PI) and S. Roy Chowdhuri

**Objective:** To develop protocol for mulberry cultivation for organic silk production. Recommendation for organic silk production strategies and norms to Govt. for accreditation procedure.

Plantation raised in experimental plots were under establishment stage.

### 10.A.1.IV.DRUDGERY REDUCTION & WOMEN FRIENDLY TECHNOLOGIES

#### 10.A.1.IV.1. AGRONOMY SECTION

**10.A.1.IV.1.1.BPP(RP)012:Optimum resource utilization through vermiculture for generating on farm value added compost.** (June, 14 to May, 15).

M. Chaudhuri.

**Objective:** To revamp the existing vermiculture in the Institute in terms of optimum resource utilization. Generating on-farm value added compost from farm and seri-waste to augment sustainability through latest vermintechnology.



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Prepared substrate with farm and seri-waste and introduced mixed culture of *Isenaea foetida*, *Perionyx excavata* and *Eudrilus euginae*. Harvested 341 kg of vermicompost.

### **10.A.1.V. PRODUCTIVITY IMPROVEMENT**

#### **10.A.1.V.1. MULBERRY BREEDING & GENETICS SECTION**

**10.A.1.V.1.1.PIB 3481: Evaluation of mulberry varieties suitable for low input soils.** (Jan., 13 to Dec., 17).

M. K. Ghosh, P. K. Ghosh, S. K. Dutta, M.V. S. Kumar (upto ), M. K. Singh (upto 31.12.14), S. N. Gogoi (RSRS, Jorhat), S. K. Misro (RSRS, Koraput), G. S. Singh (Sub-REC, Bhandra, Ranchi).

**Objective:** To evaluate newly evolved promising mulberry varieties suitable for low-input soils.

Growth and yield data of 7 selected progenies along with S-1635 (check) during February crop were recorded in two sets of experiments, normal dose for irrigated garden and 50% reduction of irrigated dose. Details of leaf yield (kg/ha/crop) are depicted Table 16.

**Table 16. Performance of mulberry accessions on leaf yield (kg/ha/crop)**

Mulberry Progeny	Leaf yield (kg/ha/crop)	
	Reduced dose of NPK	Full dose of NPK
C-1	3119	8464
C-2	4660	8189
C-3	504	8937
C-4	3681	9243
C-5	5439	9480
C-6	2861	6220
C-9	5650	10085
Check (S-1635)	1753	8317
CD at 5%	392.40	473.22

In both the conditions highest leaf yield was recorded in C-9 with 5650 kg/ha/crop in 50% reduced dose and 10085 kg/ha/ crop in full dose for irrigated condition indicating fertilizer responsive nature of the genotype.

#### **10.A.1.V.2. AGRONOMY SECTION**

**10.A.1.V.2.1.PPA 3499: Evaluation of field level performance of Vishala mulberry variety in different locations under irrigated conditions in West Bengal.** (Apr., 13 to Mar., 18).

S. K. Mandal (upto 31.03.2014), S. Rajaram, M. S. Rahman (up to 30.09.14) and Nine others from DoS and NSSO.



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

A total of 10000 cuttings each of Vishala and S1635 were planted in 12 farmer's experimental plots. Gap filling done and plantation maintained with cultural operations. Plantation at 4 farmer's experimental plot was completed during Oct., 2014 and plantation in rest 7 plots was under progress.

### **10.A.1.V.3. MULBERRY PHYSIOLOGY SECTION**

**13.A.5.3.1. BPP(P) 041: Studies on quality status and leaf yield of short listed early sprouter and late senescence mulberry accessions.** (Jan., 15 to Dec., 16).

P.K.Tewary and R.Kar.

**Objective:** Screening of mulberry accessions having early sprout and leaf senescence characters with better leaf yield and quality under low temperature condition.

Plantation of 13 short listed mulberry accessions were maintained.

### **10.A.1.V.4. SILKWORM BREEDING & GENETICS SECTION**

**10.A.1.V.4.1. AIB 3480: Development on silkworm *Bombyx mori* L. breeds from a gene pool with higher genetic plasticity.** (Sept., 12 to Aug., 16).

A. K. Verma, G. K. Chattopadhyay (till 31.10.2014), A. K. Saha, N. Suresh Kumar and N. B. Kar.

**Objective:** To develop bivoltine and multivoltine breeds with higher genetic plasticity.

**E01:** Development of multivoltine and bivoltine lines from poly-hybrids *i.e.*, convergent gene pool.

After selection of six bivoltine ( $V_2$ ) breeds, B.Con.4, CSR-2, KPG-A, DUN-21, RSJ-14 and APS-45 for high shell weight and six multivoltine ( $V_3$ ) breeds, N+p, Cambodge, Pure Mysore, M.Con.4, Sarupat and MH-1 for higher survival were collected as best performer for the target trait at specific region considering highly variable, congenial, low temperature and low RH, high temperature and low RH climatic situations. Step-wise crossing was done to raise converged gene pool for genetic assimilation among the genes for target trait to bring genetic plasticity. Two lines were separated from (B.Con.4 x CSR-2) x (KPG-A x DUN-21) x (RSJ-14 x APS-45) as Marked (+p) and Plain (p) larvae with higher shell weight.



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Similarly three lines were separated from (N+p x Cambodge) x (Pure Mysore x M.Con.4) x (Sarupat and MH-1) as Golden colour (C), White (c) and Light green (Gr) cocoon colour for higher survival. After completion of test for genetic plasticity in target trait of different lines, selected lines will be used further to develop congenic bivoltine breed for high survival and multivoltine breed for high shell weight. Performance of these lines is depicted in Table 17. Further breeding process were in progress.

**Table 17. Rearing performance of converged lines of bivoltine breeds and multivoltine breeds.**

<b>(B.Con.4 x CSR-2) x (KPG-A x DUN-21) x (RSJ-14 x APS-45)</b>										
Larval character / Cocoon colour	Fec.	Hat. (No.)	Count larvae (No.)	Cocoon (No.)	Good Cocoon (No.)	Cocoon wt (kg)	ERR (%)	SCW (g)	SSW (g)	Shell (%)
Marked (+p), White	522	520	300	265	237	0.391	88.83	1.514	0.285	18.82
Plain (p), White	518	493	300	268	243	0.377	89.83	1.462	0.278	19.16
N+p x Cambodge) x (Pure Mysore x M.Con.4) x ( Sarupat x MH-1)										
Plain (p), Golden Yellow (C)	514	498	300	269	249	0.370	90.17	1.376	0.199	14.46
Plain(p), White(c)	514	497	300	271	248	0.399	90.83	1.344	0.191	14.21
Plain (p), Light Green (Gr)	515	498	300	270	247	0.387	90.33	1.329	0.192	14.45

### **10.A.1.V.4.2.AIB 3501: Development of multivoltine silkworm (*Bombyx mori*, L.) breeds with high shell percentage and high neatness of silk filament. (Jul., 13 to Jun., 16).**

A. K. Verma, N. Suresh Kumar, N. B. Kar, G. K. Chattopadhyay (upto 31.10.14) and A. K. Saha.

**Objective:** To develop multivoltine breeds with high cocoon shell % (16-18%) and high neatness (80-85 points) of silk filament to suit the adverse climatic conditions of West Bengal.

Twenty breeds namely (BMI-0001, BMI-0065, BMI-0023, BMI-0074, BMI-0072, BMI-0069, BMI-0066, BMI-0070, BMI-0043, BMI-0048 with high shell percentage; BMI-0004, BMI-0008, BMI-0015, BMI-0011, BMI-0038, BMI-0014, BMI-0003, BMI-0016, BMI-0007 and BMI-0042 with high neatness) were brought from CSGRC, Hosur and 4 from other places, used as donor after sort listing. Four breeds namely M.Con.1, M.Con.4, M6DPE and N(+p) of CSRTI, Berhampore were used as receptor. Out of 24 breeds collected, only 9 survived during summer in West Bengal condition. Based on SR% and neatness, only one breed i.e. MH1 was selected as donor. By utilizing the selected breeds, crosses were made for initiating breeding process. Reciprocal crosses were also considered to get homozygous progeny for shell%. After introgression of the characters, sib-mating has just initiated. Finally only 8 lines were considered for further breeding process. The performance of the donor and introgressed lines were given in the Table-18.



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**Table 18. Performance of Introgressed lines vis-à-vis the donor parent.**

Breed	Fecundity (No.)	ERR (No.)	ERR (kg)	Pupa-tion (%)	SCW (g)	SSW (g)	Shell %	Neat-ness	Cumula-tive EI
<b>Parent</b>									
M.Con.1	487	9267	12.07	93	1.177	0.190	16.23	78	43.7
MH1	530	9500	14.47	95	1.558	0.240	15.47	85	49.1
<b>Introgressed lines</b>									
M.Con4 x MH1-C6,S-1	535	9200	16.20	92	1.618	0.280	17.30	88	50.5
M.Con.1 x MH1- BC6,S-1	528	9587	13.60	96	1.351	0.230	17.32	89	51.6
M6DPE x MH1- BC6, S-1	570	9400	15.10	94	1.466	0.230	15.69	86	51.0
M.Con.1 x BHB <sup>10</sup>	565	9333	12.89	93	1.438	0.248	17.25	86	50.7
B.Con.1x4 xM.Con.4	582	9200	13.52	92	1.501	0.256	17.05	89	52.9
MH1 x BHB <sup>10</sup>	528	9200	13.67	92	1.680	0.290	17.26	88	51.7
Gen3 x M.Con.4	554	9067	12.53	91	1.363	0.240	17.61	90	51.4
SK6x7 x M.Con.4	562	8833	10.90	88	1.283	0.22	17.15	88	50.6

It was revealed that all the introgressed lines were showed higher shell% (more than 16%) except M6DPE x MH1 and higher neatness (more than 84%). Further breeding process for stabilization of the characters were in progress.

### **10.A.1.V.4.3.AIB 3531: Authorization trial of silkworm hybrids in Eastern and North-Eastern India.** (Aug., 14 to Jul., 15).

A. K. Verma, N. Suresh Kumar, and A. K. Saha.

**Objective:** To evaluate the newly developed, Multi x Bi and Bi x Bi hybrids at the farmers level in Eastern & North Eastern Zone. To popularize the newly developed hybrids at the farmers level in Eastern & North Eastern Zone. To analyze the data of the tested hybrids in Eastern & North Eastern Zone. To identify the suitable hybrids for the Eastern & North Eastern Zone. Recommendation of the hybrids for the Eastern and North Eastern zone for commercial exploitation.

Dfls of Multi x Bi hybrids, M6DPC x (SK6 x SK7) and N x (SK6 x SK7) and the bivoltine hybrids, B.Con.1 x B.Con.4 and SK6 x SK7 were reared during autumn, 2014 and spring 2015 at farmers' level. Performance of hybrids is presented in the tables 19 to 24.



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**Table 19. Performance of Bivoltine hybrids in North East under Authorization Trial of silkworm hybrids (Autumn Crop, 14).**

nit	DFIs reared	Yield/100 dfls (kg)	Yield range
RSRS Jorhat	1000	41.96	(35.5- 42.7)
REC, Agartala	500	51.03	(48.0-57.3)
REC, Aizawl	500	46.50	(44.65- 50.7)
REC, Imphal	500	45.60	(41.7-50.2)
REC, Shillong	500	41.75	(31.0-48.6)
REC, Rangpo	500	38.50	(36.5-43.2)
Total/Avg.	3500	44.92	

**Table 20. Performance of Multivoltine hybrids in West Bengal and Jharkhand under Authorization Trial of silkworm hybrids (Autumn Crop, 14)**

Unit	DFIs reared	Yield/100 dfls (kg)	Yield range
REC, Mothabari	6000	44.53	(40.6-55.50)
REC, Maheshpur Raj	500	48.36	(39.8-52.4)
REC, Kamnagar	6000	58.50	(47.3-64.8)
REC, Rajmahal	2000	47.42	(44.0-52.0)
DoT(Seri), Malda	10000	45.00	(40.5-56.7)
DoT(Seri), Birbhum	4000	45.00	(39.8- 58.9)
DoT(Seri), MSD	6000	48.00	(44.0-52.0)
DoT (Seri), Nadia	1000	49.00	(46.0-54.5)
ZSSO, Malda	4000	42.40	(39.5- 44.8)
<b>Total/Avg.</b>	<b>39500</b>	<b>47.58</b>	

**Table 21. Performance of Bivoltine hybrids in West Bengal and Jharkhand (Autumn Crop, 14)**

Unit	DFIs reared	Yield/100 dfls (kg)	Yield range
REC, Mothabari	500	48.43	(45.7-52.0)
REC, Maheshpur Raj	500	56.49	(45.4-63.8)
REC, Kamnagar	500	60.70	(56.5-68.3)
REC, Rajmahal	500	57.70	(51.0-63.0)
ZSSO, Malda	2000	52.40	(47.2.0-60.0)
<b>Total/Avg.</b>	<b>4000</b>	<b>55.14</b>	

**Table 22. Performance of Bivoltine hybrids in Odisha (Autumn Crop, 14)**

Unit	DFIs reared	Yield/100 dfls (kg)	Yield range
RSRS, Koraput	500	40.0	(36.0- 45.4)
REC, Deogargh	500	43.2	(36.0-48.0)
REC, Bademaringa	500	45.0	(41.4- 48.5)
<b>Total/Avg.</b>	<b>1500</b>	<b>42.73</b>	



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**Table 23. Performance of Multi x Bi hybrids (Falguni /spring crop, 15)**

	M6DPC x (SK6 x SK7)		Nistari x (SK6 x SK7)	
	Quantity	Yield/100 dfls	Quantity	Yield/100 dfls
REC,Kamnagar	6000	56.1	2000	53.0
REC,Mothabari	6000	53.0	2000	45.0
REC, Rajmahal	1600	49.0	400	48.0
REC, M.P. Raj	400	49.6	100	45.4
DoT(Seri) Malda	6000	53.0	2000	44.0
DoT(Seri), Birbhum	8000	48.5	--	--
DoT(Seri) Murshidabad	5000	56.0	2000	53.0
DoT(Seri),Nadia	1200	50.0	300	45.0
ZSSO, Malda	4800	42.0	1200	44.7
	<b>39000</b>	<b>50.8</b>	<b>10000</b>	<b>47.26</b>

**Table 24. Performance of bivoltine hybrids (Falguni / Spring crop, 2015)**

Centre	Hybrids			
	B.Con.1 x B.Con.4		SK6 x SK7	
	Quantity	Yield/100 dfls	Quantity	Yield/100 dfls
REC,Kamnagar	400	59.0	100	56.1
REC,Mothabari	400	58.0	100	55.0
REC, Rajmahal	400	56.0	100	48.0
REC, M.P. Raj	400	51.8	100	43.3
ZSSO, Malda	800	44.3	200	48.7
	<b>2400</b>	<b>53.82</b>	<b>600</b>	<b>50.22</b>

### **10.A.1.V.4.4.AIB 3514:Development of multivoltine Congenic/NIL breed of silkworm (*Bombyx mori* L.) through introgression of 'Id' gene. (Aug., 14 to Jul., 17).**

A. K. Verma, G. K. Chattopadhyay (till 31.10.2014), A. K. Saha, N. B. Kar and S. Nirmal Kumar.

**Objective:** Development of Multivoltine (V<sub>3</sub>) based Congenic /NIL (Near Isogenic Line) / Breeds through introgression of homozygous dominant '*Id*' (Inhibitor of Diapause) gene for which acid treatment is not required during cross with bivoltine females and increase the egg production.

Method for introgression of inhibitor of diapauses (*Id*) character was introduced to develop '*Id*' character carrier homozygous females and males using Berhampore<sup>*Id*</sup> as diapause inhibitor pseudo pigmented homozygous *Id* character carrier breed as a resource material. Two types of egg phenotypic expression i.e., (i) Pseudo pigmented and (ii) Non pseudo pigmented were observed. Both are homozygous dominant for diapause inhibitor character over the obligatory sex linked maternal inherited character i.e., voltinism in *Bombyx mori* L. On the basis of



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egg phenotype, cocoon colour and cocoon shape three *Id* character carrier breeds were raised (Table 25) among which non-pseudo diapause inhibitor breed was the first report in sericulture. The homozygous *Id* character carrier either male or female have potentiality to break the diapause as *Id* character was found to be dominant over obligatory sex linked maternal inherited character. As a result, females of pure bivoltine breed/ foundation cross of bi x bi can be used in grainage to produce bi x multi dfls by crossing with any *Id* character carrier. M.Con.4<sup>Id</sup> breeds developed for commercial use where acid treatment was not required.

**Table 25. Rearing data of breeds after introgression of *Id* character.**

#	Breed	Eggs Character	Cocoon Colour & shape	Fecundity	Hat %	ERR No.	Yield/ 10,000 (kg)	SCW (g)	SSW (g)	Shell %	F.L (m)
1.	M.Con.4 <sup>Id</sup>	Non pigmented,	Golden Yellow (C), Oval	428	96	9400	11.67	1.30	0.222	17.10	684
2.	M.Con.4 <sup>Id</sup>	Pseudo pigmented,	Butter colour, Oval shape	423	96	7600	10.43	1.31	0.224	17.09	690
3.	M.Con.4 <sup>Id</sup>	do	Golden Yellow (C), Oval	437	97	9233	11.27	1.21	0.238	19.70	688
4.	M.Con.4 (Check)	Normal multivoltine	Golden Yellow (C), Oval	499	97	9433	10.30	1.253	0.192	15.32	582
5.	B.Con.4 <sup>Id</sup>	Pseudo pigmented,	Butter colour, Oval shape	450	96	9567	11.50	1.45	0.287	19.8	722
6.	B.Con.4 (Check)	Pigmented, Diapause	Faint constricted, White (c) Colour	530	97	9267	12.33	1.38	0.259	18.76	719
7.	BHB <sup>Id</sup>	Pseudo pigmented, Diapause Inhibitor	White (c), Oval shape White (c), Faint dumbbell	410	95	8933	12.97	1.44	0.244	16.90	621

### 10.A.1.V.5. SILKWORM PHYSIOLOGY & RTI SECTION

#### 10.A.1.V.5.1.BAR(VP)013:Validation cum Refinement of Open Rearing House during February-March (Falguni) 2015 crop. (Jun., 14 to May, 15).

A. K. Saha, T. Datta (Biswas) ( up to June, 14) and N.B. Kar.

**Objectives:** Validation and refinement of Open Rearing House during Commercial crop seasons of West Bengal.

During Feb-March (Falguni ) '15 crop 50 dfls each of SK6 and SK7 were reared in Open Rearing House (ORH) with shelf rearing method. Control Rearing was conducted by following traditional Tray rearing method in the normal Rearing House. Result is depicted in Table 26.



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**Table 26. Performance of silkworm rearing under Open Rearing House condition**

Breed		SC W (g)	SSW (g)	SR%	Yield/ 100 dfls (kg)	Temp		Humidity		Bed Spacing /100dfls	Gain %
						Max °C	Min °C	Max %	Min %		
SK6	ORH	1.47	0.24 9	16.93	52.8	25 (24-28)	21 (15-24)	74	72	720	4.1 %
	Cont	1.43	0.23 9	16.71	50.7	24.5 (24-29)	23 (21-24)	79	77	480	
SK7	ORH	1.51	0.25 1	16.62	51.2	25 (24-28)	21 (15-24)	74	72	720	4.1
	Cont	1.49	0.24 2	16.24	49.2	24.5 (24-29)	23 (21-24)	79	77	480	

Under Open Rearing House in shelf rearing method, 34% labour saving was noted besides 4.1% gain in cocoon production.

### 10.A1.VI. DISEASE & PEST MANAGEMENT

#### 10.A.1.VI.1. MULBERRY PATHOLOGY SECTION

##### 10.A.1.VI.1.1.CSS-2107: Forewarning of mulberry diseases of Eastern and North Eastern India. (Sept., 12 to Aug., 17).

S.K.Dutta, M. D. Maji, T.Dutta Biswas, A. K. Dutta, D.Pandit, S.T.Lepcha, M.Alam, S.K.Misroo, R.Das, A.Borah, G.B.Singh, B.N.Choudhuri, L.S.Singh, B.K.Basumatary, M.Z.Collin.

#### Objectives:

- Collection of disease incidence (in weekly interval) and meteorological data (day wise) from Eastern and North Eastern India.
- Publicity and recommendation of package of forewarning system in different locations.
- Development of long term and broad spectrum data base for disease and meteorology of Eastern and North Eastern India at the end of XII plan period.
- Due to climatic change existing disease forecasting models to be fine tuned at the end of XII<sup>th</sup> plan and more models to be developed when severity of disease is > ETL.
- Due to climatic change existing disease calendar (as developed in the XI<sup>th</sup> plan period) to be fine tuned at the end of XII<sup>th</sup> plan.

The study was conducted at the Institute and in 13 coordinating units. Disease incidence data were recorded under test centers at weekly intervals alongwith day wise meteorological data. Disease severity was correlated with meteorological factors viz. mean max. and min. temperature, mean max. and min. relative humidity, no. of rainy days, rainfall of Murshidabad district. In Eastern and North Eastern India, severity of different diseases in different months was recorded.

**CO-ORDINATING UNITS:** (1) CSR&TI, Berhampore (Murshidabad), (2) REC, Bagmara (Malda), (3) REC, Kamnagar (Murshidabad, including Birbhum), (4) RSRS, Kalimpong (West Bengal), (5) REC-Rangpo (Sikkim), (6) RSRS, Ranchi (Jharkhand), (7) REC, Maheshpur Raj (Jharkhand), (8) RSRS, Koraput (Odisha), (9) RSRS, Jorhat (Assam), (10) REC, Dimapur (Nagaland), (11) REC, Aizawl (Mizoram), (12) REC, Agartala (Tripura), (13) REC, Imphal (Manipur).(14) REC, Mangaldoi(Assam) and (15) REC,Shillong (Meghalaya).



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### Forewarning of mulberry diseases in Eastern and North Eastern India.

Place	Disease PDI				
	BLS	MLS	PLS	PMLD	BLR
Murshidabad	2.13 to 9.69*	2.13 to 9.27*	2.53 to 21.87*	2.74 to 20.89*	6.56 to 13.78*
Malda	-	0.63 to 6.79*	1.88 to 7.13*	-	-
Birbhum	0.85 to 27.38*	4.29 to 7.63*	5.36 to 25.98*	-	-
Kalimpong	0.68 to 45.19*	-	-	-	2.79 to 9.63*
Rangpoo	-	-	-	1.06 to 2.18	1.05 to 2.19
Koraput	-	-	-	2.97 to 4.63	2.11 to 23.68*
Ranchi	-	-	-	0.23 to 1.21	-
M.P.Raj	-	-	-	0.43 to 1.79	-
Jorhat	-	-	-	-	0.12 to 0.21
Dimapur	-	-	-	-	0.60 to 2.30
Imphal	-	-	-	0.21 to 6.63*	0.42 to 0.62
Aizawl	-	-	-	2.82 to 12.97*	1.36 to 6.13*
Shillong	-	-	-	1.30 to 2.67	-
Mangaldoi		2.61 to 13.85		9.18 to 14.55*	3.84 to 18.63*

\* = Above ETL, **BLS** – Bacterial Leaf Spot, **MLS** – Myrothecium Leaf Spot, **PLS** – Pseudocercospora leaf spot, **PMLD** – Powdery mildew, **BLR**- Brown Leaf rust

#### 10.A.1.VI.1.2. PPS 3504: Study of root rot disease of mulberry in the Gangetic plains of West Bengal and development of its control measure. (Apr., 14 to Mar., 17).

S. K. Dutta, A. K. Dutta and T. Dutta (Biswas).

**Objectives:** Survey and collection of root rot disease from the Gangetic plains of West Bengal. Isolation and identification of the organism causing root rot disease of mulberry. Recording of severity of root rot disease of mulberry in different locations of the Gangetic plains of West Bengal. Isolation of fungicide as control measure (*in vitro*) for plant root protection method including bio control agents and chemical management.

In the context of current status, survey at Bangalgram area of Malda, Kalyanpur of Birbhum Gomakhali area of Nadia and Banjetia and Balaspur area of Murshidabad shows rot infection in S1635. Rot fungus collected from Malda (In old plantation) area was sent to IARI, New Delhi and was reported as *Laciodiplodia theobromae* (= *Botryodiplodia theobromae*). Moreover fungus collected from Birbhum, Malda and Nadia area is reported as *Fursariun solani*. Isolated pure culture of fungus was identified from IARI, New Delhi and fruit body was identified from NFCCI, Pune. Multiple infection caused by both the fungus in the same plant is rare.



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In Banjetia and Balaspur village of Murshidabad rot incidence was noticed in < 10 years old plantation. 5 to 8.7% rot incidence was recorded from Banjetia village but in Balaspur village incidence of rot disease was 13.7%. In Bangalgram area Malda and in REC Mothbari incidence of rot disease was recorded in <10years old plantation. In Mothabari farm rot incidence is 2% but in Bangalgram area disease was flourished and severity was ranging from 25 – 40%.In Kalyanpur village of Birbhum incidence was ranging from 9 to 22. Gomakhali area of Nadia rot incidence was recorded in 10-20 years old plantation and incidence was ranging from 13.75 to 15%.

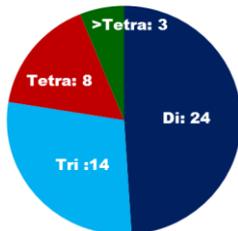
### 10.A.1.VI.2. BIO-TECHNOLOGY SECTION

#### 10.A.1.VI.2.1.BPI(P)034:Development, characterization and validation of expressed sequence tag derived microsatellite markers for mulberry.(Sept., 14 to Aug., 17).

S. Chattopadhyay and R. Banerjee.

**Objectives:** Development of genic SSR primers using available expressed sequence tags of mulberry. Evaluation of information generation ability of developed primers on a segregating population. Assessment of transferability of identified SSRs using a panel of mulberry species.

To develop the microsatellite markers, all (~4600) ESTs of *M. indica* and *M. alba* were retrieved from the Gene Bank (up to Feb., 2015). Utilizing ESTs ( $\geq 125$ bp), a total of ~900 unigenes were generated using suitable software. All unigenes were then screened *in silico* for the presence of microsatellites with the criteria of 8, 6, 5, 4, and 4 repeating units for di-, tri-, tetra-, penta-, and higher-order nucleotides, respectively. A total of 49 unigenes with candidate microsatellites were found suitable for primer design using Primer 3.0 software, with a length of 17 – 24 bp, annealing temperature of 50-60°C, and product sizes ranging from 100 to 300 bp. On analysis it appeared that SSRs was dominated by simple dimers, followed by trimers and tetramers (Fig.3). Processing of 45% of *M. notabilis* sequences (~60,000 as on Feb., 2015) has also been completed for candidate SSRs determination.



**Fig.3.** Number of di-, tri-, tetra and greater than tetra nucleotide SSRs of different repeat lengths obtained from the unigenes of retrieved ESTs of *Morus indica* and *Morus alba*.

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### **10.A.1.VI.2.2.PIB 3521: Assessment of promising powdery mildew resistance lines for perspective commercial use.** (Jan., 15 to Dec., 17).

S. Chattopadhyay, R. Banerjee and A. K. Saha.

**Objectives:** Evaluation of powdery mildew resistant promising lines for foliage biomass and associated ancillary traits. Evaluation of silkworm rearing efficiency of the selected line(s) through bioassay. Development of segregating progeny using sib-mating from promising F<sub>1</sub> lines. Assessment of powdery mildew responsiveness of developed progeny using identified markers for MAS based utilization.

A total of 4000 clonal cuttings of 10 promising lines derived from the cross of powdery mildew resistance x susceptible lines [*pseudo* F-2 (F-1)] were raised in nursery along with all suitable parental and spreader clones for establishment in RBD. Sib-mating and back crossing of identified transgressive segregants (3-4 lines) for powdery mildew resistance and better foliage yield (S-1 x Vietnam-2 and Philippines x Vietnam-2) were done and seedlings were raised in the nursery.

### **10.A.1.VI.2.3.ENTOMOLOGY SECTION**

#### **10.A.1.VI.2.3.1. PPE 3517: Population interactions of pests and natural enemies in mulberry eco-system.** (Aug., 14 to July, 17).

N. Lalitha, M.V. Santha Kumar (up to 03.01.15), Debojit Das, A.K.Saha, U.C Boruah and S. Chatterjee.

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

#### **E01. Tritrophic interactions between host plant, pests and natural enemy complex.**

Extensive survey on mulberry pest and natural enemies along with their alternate hosts was carried out four sericultural districts viz. Murshidabad, Birbhum, Nadia and Malda of West Bengal. The seasonal incidence of major mulberry pests along with their natural enemies at fortnightly intervals was recorded. Host range of pests and their natural enemies, migration of pests and their natural enemies were studied. Incidence of pests on mulberry and alternate hosts at adjoining tracts of mulberry gardens presented in Table 36. Throughout the year, incidence of nymphal stages of two species of whitefly, *Dialeuropora decempuncta* (Quaintance & Baker) and *Aleuroclava pentatuberculata* Sundarraj & David (Homoptera : Aleyrodidae) was recorded on the alternate host plant, *Musa* spp. The whitefly population in banana leaf (plate 2.1) ranged from 24 to 137/leaf and migration of whitefly from banana plantation to mulberry gardens were observed during Sept. to Oct. During Jan. to Feb., 15 whitefly was recorded in the ornamental plant *Ixora* spp.(45.50/leaf) (plate 2.3, 2.4). Bihar Hairy caterpillar, *Spilosoma obliqua* was recorded in jute plantations from where sporadic incidence of pests occurred in adjacent mulberry gardens.



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The mealy bug complex found in the mulberry ecosystem includes *Maconellicoccus hirsutus*, *Paracoccus marginatus*, *Phenacoccus parvus* etc. Life stages of the mealy bugs were recorded on mulberry (plate 2.5), China rose (*Hibiscus rosasinensis*) (plate 2.2), fruits and leaves of papaya (plate 2.7, 2.8) and Brinjal (plate 2.9, 2.10). During Feb.- Mar., 15 *Acalypha indica* an ornamental plant was found to host the nymphal/ adult population of mealy bugs (plate 2.6). Thrips were recorded in chillies as well as in mulberry. The native predators associated with thrips population viz., *Micraspis discolor* and *M. crocea* found to be low (0-1/plant) in chillies. Thrips incidence start from March onwards in mulberry crop. Mite infestation was recorded in mulberry during the period. The cut worms, *Spodoptera litura* Hubner (Lepidoptera: Noctuidae) were recorded in mulberry where horticultural crops like marigold, tomato, brinjal and red amaranthus are grown on neighbouring plots. But seasonal incidence of spodoptera pest was not noticed in all the surveyed districts. During Feb., 15, root knot nematode infestation was recorded in few mulberry plants. Aphids were observed in cucurbitaceous plants such as pointed gourd, ridge gourd, bitter gourd, cucumber and pumpkins in adjacent to mulberry in Nadia District. Aphid *Lipaphis erysimi* (plate 2.11) infestations were recorded severely on mustard crop adjacent to mulberry plot. The recorded natural enemies were sent to NBAIR, ICAR, Bangalore for identification.



Plate 2. Alternate hosts of mulberry pests from adjoining tracts of mulberry gardens .1. whitefly nymphs on *Musa* spp. 2 Mealy bug complex in hibiscus 3. Whitefly nymphs colonized on *Ixora* spp.4. Whitefly adults on *Ixora* Spp.5. Papaya mealy bug infestation in mulberry 6.Mealy bug infestation in *Acalypha indica* 7.8 Mealy bug infestation in papaya fruits and leaf. 9,10. Mealy bug infestation in brinjal,11. *Lipaphis erysimi* in Mustard

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**Table 27. Month-wise incidence of pests on mulberry and alternate hosts at adjoining tracts of mulberry gardens**

Month 14-15	Pests on Mulberry					Alternate hosts					Adjoining crops	Others
	Thrips	Mealy bug	Whitefly	BHC	Spodoptera	Thrips	Mealy bug	Whitefly	BHC	Spodoptera		
Aug, 14		+	+	+	+		Hibiscus, Papaya	<i>Musa spp</i>	Jute		Paddy, Brinjal, Tomato, Papaya	*
Sept, 14		+	+	+	++		Hibiscus, papaya	<i>Musa spp</i>	Jute	Brinjal, Tomato, red amaranthus, Marigold	red amaranthus, Marigold	
Oct, 14			+			Chilli	Hibiscus, papaya	<i>Musa spp</i>			Lepidopteran pests in Potato, cauliflower,	*
Nov, 14			+			Chilli	Hibiscus, papaya	<i>Musa spp</i>			Cabbage, Radish, etc Aphids in cucurbitaceous plants.	<i>Micraspis discolor and M.crocea</i>
Dec, 14			+			Chilli	Brinjal, Hibiscus	<i>Musa spp</i>			No pest in Wheat and Maize	
Jan, 15			+			Chilli	Brinjal, Hibiscus, papaya	<i>Musa spp</i>			Aphids and Jassids in Cole crops tomato, Brinjal.	
Feb, 15	+					Chilli	Brinjal, Hibiscus	<i>Musa spp</i>			<i>Lipaphis erysimi</i> in Mustard, No pest in Wheat, Jowar and Maize	Root knot Nematode
Mar, 15	+	+					<i>Acalypha indica</i> , Brinjal, Hibiscus, papaya	<i>Ixora spp</i> , <i>Musa spp</i>				Predators <i>Cheilomenes sexmaculatus</i> and <i>Coccinella spp.</i>

\*Screened parasitoids and sent to National Bureau of agricultural insect resources, ICAR, Bangalore for identification.

### **10.A.1.VI.3.2. BPR (P) 021: Development of weather based forecasting models for mulberry pests. (Jan., 11 to Dec., 15).**

S.K.Mukhopadhyay, M.V.Santha Kumar (upto 03.01.2015), N.Lalitha, T. Dutta (Biswas), A.K. Dutta, S.Chatterjee, D.Singh and N.R.Rao.



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**Objectives:** To develop a data base on climatic factors and incidence of major pests of mulberry. To establish pest incidence and weather relationship. To develop region wise forecasting models for different pests of mulberry.

Incidence of major mulberry pests were recorded at the Institute's field, three traditional districts of Gangetic plains (Malda, Murshidabad and Birbhum) and Kalimpong hills of West Bengal at weekly intervals. At the institute's plot, thrips incidence prevailed during April to Sept. and Jan. to Mar., 15. Maximum population was recorded during June (12/leaf). In Murshidabad and Birbhum district, thrips population was from April to Aug. (14- 52/leaf). In Malda district, thrips population was maximum during June, (38/leaf). Tukra infestation was recorded during May to July in the institute and Murshidabad district (9-10%) and maximum recorded during July. In Birbhum district, tukra infestation ranged from 9.7 to 18.1 % during May to July, while in Malda maximum tukra incidence was recorded during June, 14 (15%). Whitefly population was recorded during Oct. to Dec., in the institute plots, ranging from 2-15/leaf. In Murshidabad district, the whitefly population was 8/leaf during Sept. During Oct. to Dec., whitefly population was 2-12/leaf in S1 and 3-14/ leaf in S1635. In Birbhum district during Sept. to Dec., whitefly population was 5 -15/ leaf. In Malda district, the whitefly incidence was 2-12/leaf during July to December. In Kalimpong hills, incidence of root mealy bug prevailed throughout the year with maximum infestation (8/plant) during June. Leaf webber was prevalent during Apr. to Nov. In Jorhat, pest incidence data revealed that thrips population was prevalent during April to June and maximum during May (6/leaf). Tukra infestation was prevalent during April to June and the maximum (8%) during June. Whitefly incidence was recorded during Aug. to Oct. with a population of 6-23/leaf. In Koraput, though all the major pests viz. thrips, whitefly and mealy bug were found throughout the year but their incidence was below Economic Threshold Level.

### **10.A.2.Regional Sericultural Research Station**

#### **10.A.2.1. KALIMPONG (W.B.)**

**10.A.2.1.1.B-KPG(PS)006: Diagnosis of nutrient constraints and its management in mulberry field at farms and farmers' level at Kalimpong hills.** (Apr., 14 to Mar., 16).

R.L. Ram and S. Chatterjee.

**Objective:** To diagnosis of nutrient constraints in soil and plants at farm and farmers' field. To study the effect of integrated nutrient management on soil health and mulberry leaves at farm and farmers' field. Bioassay of treated mulberry leaves to check adverse effect of the press mud on silkworm.

**Morpho-Physico-Chemical Properties of soils:** Soils of Kalimpong hills was shallow to very deep in depth; dark yellowish brown (10 YR 4/4) to brown (10 YR 5/4 and 6/4) in colour; sandy loam to sandy clay loam texture;



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single grain to fine, medium, subangular blocky structure; dry semi hard, moist very friable to friable, wet slightly sticky to sticky and wet slightly plastic consistency; very fine to fine, few to many pores and clear to gradual smooth to wavy horizon boundary. Sand, silt and clay percent in these areas ranged from 62-75%, 10-18% and 12-23% respectively which were classified as sandy loam to sandy clay loam Table-28.

**Table 28. Chemical properties of the soils.**

Soil parameters	RSRS farm	Farmers field ( I)	Farmers field (II)
pH (1:2.5)	5.42	5.40	5.80
EC (dSm <sup>-1</sup> )	0.12	0.10	0.12
Organic C (%)	1.42	1.29	1.89
Available N (Kg ha <sup>-1</sup> )	504.3	474.2	502.1
Available P (Kg ha <sup>-1</sup> )	18.7	17.4	16.4
Available K (Kg ha <sup>-1</sup> )	179.2	291.4	268.8
Available S (Kg ha <sup>-1</sup> )	14.9	12.3	11.8

Maximum leaf yield of 6.74±(0.54) mt ha<sup>-1</sup> was recorded during autumn crop after the application of NPK @ (150:50:50) kg ha<sup>-1</sup> + FYM @ 5 mt ha<sup>-1</sup> + Press mud @2000 kg ha<sup>-1</sup> + recommended dose of lime (T<sub>3</sub>) followed by maximum 6.41±(0.52) mt ha<sup>-1</sup> after the application of NPK @ (150:50:50) kg ha<sup>-1</sup> + Press mud @2000 kg ha<sup>-1</sup> + recommended dose of lime (T<sub>5</sub>) against the control (recommended) 5.81±(0.33) mt ha<sup>-1</sup> at RSRS, Kalimpong farm. Total Soluble Protein; Total Soluble Sugar; Total Nitrogen and Crude Protein were also high in treatments T<sub>2</sub> and T<sub>5</sub> as compared with control (T<sub>1</sub>). Similar trends for leaf yield have also been recorded in the farmers' field. Details of the effect of press mud on yield and quality of mulberry leaves at RSRS farm and farmers' level are given below in Table 29.

**Table 29. Effect of press mud on yield and quality of mulberry leaves at RSRS farm**

Treatment	Yield (mt ha <sup>-1</sup> )	Gain (%)	Yield (mt ha <sup>-1</sup> )		Gain (%)		Moisture (%)	Fresh weight (mg g <sup>-1</sup> )			Dry Weight (%)	
			Farmer's field I*	Farmer's field II	Farmer's field I*	Farmer's field II		TCH	TSP	TSS	TN	CP
T <sub>1</sub>	5.81 ±0.33	0.00	4.00 ±0.44	0.00	4.12 ±0.25	0.00	75.62 ±0.27	1.28 ±0.03	20.04 ±0.15	29.19 ±0.48	2.96 ±0.10	18.51 ±0.61
T <sub>2</sub>	6.31 ±0.33	8.60	4.25 ±0.44	6.27	4.43 ±0.45	7.43	76.10 ±0.37	1.46 ±0.02	24.48 ±0.29	33.33 ±0.23	3.13 ±0.11	19.56 ±0.67
T <sub>3</sub>	6.74 ±0.54	16.0	4.62 ±0.31	15.40	4.75 ±0.16	15.3	76.84 ±0.44	1.66 ±0.02	25.78 ±0.23	34.85 ±0.17	3.44 ±0.08	21.53 ±0.50
T <sub>4</sub>	5.53 ±0.50	-4.82	3.91 ±0.49	-2.25	3.87 ±0.15	-6.00	75.01 ±0.55	1.23 ±0.01	18.87 ±0.17	28.79 ±0.17	2.88 ±0.10	18.00 ±0.61
T <sub>5</sub>	6.41 ±0.52	10.3	4.53 ±0.37	13.28	4.52 ±0.60	9.81	75.91 ±0.42	1.60 ±0.02	25.17 ±0.16	32.97 ±0.35	3.34 ±0.11	20.8 ±0.68

±: Standard Error; TCH: Total Chlorophyll; TSP: Total Soluble Protein; TSS: Total Soluble Sugar; TN : Total Nitrogen; CP : Crude Protein, \*Age of plantation 3 years.

**Treatments: T<sub>1</sub>: Control:** NPK @ (150:50:50) kg ha<sup>-1</sup> + FYM@ 10 mt ha<sup>-1</sup> + recommended dose of lime (Recommended); **T<sub>2</sub>: Integrated nutrient management combination (I):**



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NPK @ (150:50:50) kg ha<sup>-1</sup>+FYM @ 5 mt ha<sup>-1</sup> + Press mud @1000 kg ha<sup>-1</sup> + recommended dose of lime; **T<sub>3</sub>: Integrated nutrient management combination (II)**: NPK @ (150:50:50) kg ha<sup>-1</sup> + FYM @ 5 mt ha<sup>-1</sup> + Press mud @2000 kg ha<sup>-1</sup> + recommended dose of lime; **T<sub>4</sub>: Integrated nutrient management combination (III)**: NPK @ (150:50:50) kg ha<sup>-1</sup> + Press mud @1000 kg ha<sup>-1</sup> + recommended dose of lime; **T<sub>5</sub>: Integrated nutrient management combination (IV)**: NPK @ (150:50:50) kg ha<sup>-1</sup> + Press mud @2000 kg ha<sup>-1</sup> + recommended dose of lime.

### **10.A.2.1.2.B-KPG(VP)011:Validation of test based doses of fertilizers and lime application in soils of Kalimpong hills to increase the yield and quality of mulberry (*Morus spp.*) leaf. (Apr., 14 to Mar., 16).**

R. L. Ram and S. Chatterjee.

**Objective:** Validation of test based doses of fertilizers and lime application in soils of Kalimpong hills to increase the yield and quality of mulberry (*Morus spp.*) leaves.

Dolomite was applied @ 1.5 mt/ha in 10 selected farmers field. Recommended and test based doses of fertilizers and lime were applied from Spring crop (April 2015) at all the farmers field. Plantation was maintained.

### **10.A.2.2. KORAPUT**

#### **10.A.2.2.1. BPP (P) 030: Studies on high bush and tree type mulberry plantation under rainfed condition of Odisha (Jun., 14 to Mar., 19).**

Rushi Sahu

**Objective:** To develop a package of practice for high bush and tree type mulberry plantation to avoid grazing problems in state of Odisha.

Transplanted mulberry saplings of S-1635 and C-1730 in experimental plots during Aug., 14 was done and maintained with recommended package of practices. As per suggestion of RRAC the spacing were modified as 5' x 5', 6' x 6' and 8' x 8'.

#### **10.A.2.2.2. B-KPT (PS) 009: Effect of Irrigation scheduling on yield and water economy in mulberry by use of Hydro-gels –Poly acrylic acid based water insoluble polymers. (Jul., 14 to Jun., 16).**

S. K. Misro

**Objectives:** Develop a package of practice using the hydrogels for sustainability of sericulture industry. Scientific management of water to make it available for longer periods after the field is irrigated. Increasing the efficacy of the fertilizers by its gradual release along with water. Increasing the survival % of mulberry during water stress conditions. Increasing the survival % of saplings.



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Transplantation with S1635 sapling and application of Hydrogel as per treatments were done. Cultural operation and irrigation done and plantation was under establishment stage. As per suggestion of RRAC the schedule of irrigation were changed by assessment through calculation of pan evaporation rate and field capacity.

### **10.A.2.2.3.B-KPT(P) 037: Verification of predicted lime requirement for the acid soils of Koraput region under mulberry vegetation in Eastern ghat highland zone of Odisha.** (Oct., 14 to Sept., 16).

S. K. Misro.

**Objectives:** To determine the soil specific lime requirement involving pH and Organic Matter for red and laterite soils. To maintain the soil health by judicious application of lime in the form of paper sludge for sustainable mulberry production. To study the economics of the use of amendments in terms of cost benefit ratio for mulberry production.

Soil samples were collected, analysis for Organic carbon and pH were completed. Application of lime in the form of paper sludge was made. Derivation of soil specific lime requirement and its study on the impact of foliage due to soil reclamation to be studied.

### **10.A.2.2.4.BPP (VP) 010: Multilocational validation trial for application of cationic micronutrients.** (Apr., 14 to Jun., 16). (Collaborative with MI)

R. Kar, S. Chatterjee, S. K. Misro, G. S. Singh, S. N. Gogoi, A. K. Dutta and T. Datta (Biswas).

**Objective:** To examine the validity of the technology for spraying of cationic micronutrients in mulberry garden.

Soil samples were collected from farmers' fields and analyzed to ascertain the status of availability of critical micronutrient in comparison to the critical level of their soil availability. Based on the soil test value, spray of derived concentration of zone-wise critical micronutrient on mulberry were undertaken and the same reveals an encouraging response percentage in terms of mulberry leaf productivity (Table 30).

**Table 30. Effect of micronutrient-spray on mulberry leaf productivity.**

Farmers under the unit	Leaf yield (kg ha <sup>-1</sup> )		Response (%)
	Control	Treatment	
RSRS, Koraput (0.17% Zn)	3661	3860	5.44
REC, Bhandra (0.17% Zn)	2906	3105	6.85



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### 10.A.2.3. RANCHI

#### 10.A.2.3.1. B-RNC(P)031: Screening and Identification of Bivoltine hybrids suitable for Jharkhand. (Jun., 14 to Feb., 17).

M. Alam

**Objective:** To identify suitable Bivoltine breeds for Jharkhand state.

Four dfls each of 12 different combination viz. CSR2× CSR4, CSR2 × CSR5, CSR3× CSR6, CSR16× CSR17, CSR46× CSR47, CSR50× CSR51, (CSR6 × CSR26) × (CSR2 × CSR27), (CSR52 × CSR50)× (CSR51×CSR53), SLD4 × SLD8, Gen3 × Gen 2, SK6 × SK7 and NB18 × P5 were reared during Aug., Sept., Oct., 14 and Mar.,15 seasons. Among the hybrids, SK6×SK7 and NB18×P5 yielded 55.8 kg and 59.8 kg cocoons /100 dfls, respectively during Aug.14 crop. During Sept., 14, SK6×SK7 and NB18×P5 yielded 52 kg and 62 kg cocoons/100 dfls, respectively, while in Oct.,14, SK6×SK7 yielded 50 kg cocoons/100dfls. During Mar., 2015, SK6×SK7 yielded 72 kg cocoons/100 dfls, while, other hybrids showed poor performance.

### 10.A.2.4. JORHAT

#### 10.A.2.4.1.PRE 3511: Studies on predatory efficacy of coccinellid predator, *Scymnus posticalis* Sicard for management of whitefly on mulberry. (Apr., 14 to Mar., 16).

Y. Debaraj

**Objective:** To evolve standardization of mass multiplication technique of the predator, *Scymnus posticalis* Sicard. To evaluate predatory efficiency of *Scymnus posticalis* Sicard against whitefly, *Dialeuropora decempuncta* on mulberry.

The laboratory cultures of host and predators have been established. Studies on biological attributes of the predator on whitefly have been completed (Table 31).

**Table 31. Biological attributes of *Scymnus posticalis* Sicard on whitefly**

Life cycle stages	Duration of development (days)	
	Mean	Range
Egg	5.12	4.23 – 6.35
Larvae (I – IV instar)	13.94	10.82 – 17.06
Pre-pupa	2.06	1.45 – 2.67
Pupa	7.28	6.23 – 8.34
Egg to adult	28.40	22.73 – 34.42
Oviposition period	24.45	19.82 – 29.30
Fecundity	14.52	11.32 – 18.45



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### 10. B. CONCLUDED RESEARCH PROJECTS / PROGRAMMES

#### LIST OF CONCLUDED RESEARCH PROJECTS AND PROGRAMMES

21 Nos. (5 Project+ 12 Prog.+ 4 Pilot Study)

Sl. No.	Code	Title	PI of the Proj/prog.
1.	<b>PIP 3469</b>	Screening of early sprouters and late senescence mulberry variety with better leaf yield and quality under low temperature condition. (Nov.,11 to Oct., 14)	P. K. Tewary, Sci.-D
2.	<b>AIP 3472</b>	Standardization and determination of temperature tolerance potentiality in different developmental stages of silkworm, <i>Bombyx mori</i> L. (Sept., 11 to Aug., 14)	A.K. Saha, Sci.- D
3.	<b>BPR (PS)003</b>	Identification of DNA markers associated with Bacterial Leaf Spot resistance in mulberry ( <i>Morus spp.</i> ) ( Apr., 13 to Mar., 15)	R. Banerjee, Sci.-D
4.	<b>BAR (PS)004</b>	Testing of immunogens for prevention of silkworm diseases in <i>Bombyx mori</i> L. (Jul., 13 to Jun., 14)	S. Chakraborty, Sci.-C
5.	<b>BAR (VP)009</b>	'Ghar Sodhan' – a fumigant room disinfectant for silkworm disease management. (Jan., 14 to Dec., 14)	S. Chakraborty, Sci.-C
6.	<b>BAR (RP)005</b>	Survey and surveillance of silkworm diseases in traditional sericultural districts of West Bengal. (Apr., 14 to Mar., 15)	S.Chakraborty, Sci.-C
7.	<b>BAI (RP)006</b>	Silkworm Disease Monitoring of Seed and Commercial Crop (SDMSCC) rearing of West Bengal. (Apr.,14 to Mar., 15)	S.Chakraborty, Sci.-C
8.	<b>AIE 3454</b>	Evaluation of elite bivoltine silkworm germplasm under different agro climatic conditions: All India Silkworm Germplasm Evaluation Programme Phase-II. [Networking collaborative project of CSGRC, Hosur] (Sept., 11 to Aug., 14)	M. K. Singh, Sci.-D
9.	<b>AIB 3491</b>	Post Authorization trials of silkworm hybrids in Eastern & North-Eastern India. (Sept., 12 to Dec., 14)	N. Suresh Kumar, Sci.-D
10.	<b>BPP (P)023</b>	Optimum requirements of irrigation water and its managements for sustainable leaf product-ivity in high yielding mulberry garden under West Bengal conditions. (May., 13 to Apr., 14)	S. Rajaram, Sci.-D
11.	<b>BAI (P)029</b>	Large scale trial on trial on development Id gene carrier multivoltine congenic <i>Bombyx mori</i> breed for studying the eggs nature and behavior after crossing with diapausing strains/ breeds. (Apr., 14 to Aug., 14)	G.K.Chattopadhyay, Sci -D
12.	<b>BAR (P)024</b>	Identification of pathogens causing Gattine like disease in the silkworm <i>Bombyx mori</i> L. (Jul., 13 to Dec., 14)	Z. Hossain, Sci.-C
13.	<b>BPP (VP)015</b>	Validation of E3 (Efficient Economic Eco-friendly) WM, SH / PM at nested units and farmers' field level. (Oct., 13 to Mar., 15)	S. Rajaram, Sci.-D



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14.	<b>B-KPG (P)028</b>	Elimination of diapauses expression from eggs in improved multivoltine silkworm breeds. (Apr., 14 to Jan., 15)	S.Chatterjee, Sci.-D
15.	<b>B-KPG (RP)010</b>	Survey & Surveillance of Mulberry and silkworm diseases & pests in Kalimpong Hill. (Oct., 13 to Sept., 14).	S. Chatterjee, Sci.-C
16	<b>B-KPG (P)006</b>	Muga seed multiplication prog.: Raising of Muga host plantation at RSRS-Annex, Kalimpong. (RSRS, Kalimpong) (Nov., 09 to Oct., 14)	M. D. Maji, Sci.-C
17	<b>B-KPG (PS)007</b>	An integrated approach to study the effect of Potassium Humate on soil health, yield and quality of mulberry leaves to promote sustainable sericulture in Sub-Himalayan region of Eastern and North-eastern India. (Apr., 14 to Mar., 15)	R.L.Ram, Sci-B
18	<b>B-KPT (RP)013</b>	Survey and surveillance of silkworm diseases in non-traditional districts of Odisha. (Apr., 14 to Mar., 15)	N.R. Rao, Sci.-C
19	<b>B-KPT (RP)014</b>	Silkworm Disease Monitoring of Seed and Commercial Crop Silkworm Rearing of Non-Traditional districts of Odisha. (Apr., 14 to Mar., 15)	N.R. Rao, Sci.-C
20.	<b>MOE 3459</b>	Yield gap in mulberry sericulture– A study in North-Eastern region of India (Oct., 11 to Apr., 14)	M. Pamehgam, Sci-C
21	<b>B-JRH (PS)005</b>	Identification of productive Multi x Bi hybrids for plains of NE states of India through development of improved multivoltine breeds of silkworm, <i>Bombyx mori</i> L utilizing local indigenous strains. (Apr., 13 to May, 14)	T.K. Biswas, Sci.-D

### 10. B. CONCLUDED RESEARCH PROJECTS / PROGRAMMES

#### 10.B. 1.MAIN INSTITUTE

##### 10.B.1.1. AGRONOMY SECTION

##### 10.B.1.1.BPP(P)023:Optimum requirement of irrigation water and its management for sustainable leaf productivity in high yielding mulberry garden under West Bengal conditions. (May, 13 to Apr., 14).

S. Rajaram

**Objective:** To find out actual irrigation water requirement for high yielding mulberry under different climatic conditions.To find out optimum level of irrigation water of irrigation for quality linked sustainable leaf productivity in high yielding mulberry garden.

**Materials & Methods:** ETc (Evapo-transpiration of crops) based irrigation water requirement on crop co-efficient approach as per FAO's modified Penman-Monteith equation using Cropwat-8 (FAO's Software) (Richard *et al.*, 1998) deviation from traditional approach of IW: CPE value (Naoi 1975) for efficient water management in mulberry.



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FAO's Modified Penman-Monteith equation		Experiment design	Split split	Var. (1)	S1635
$ET_c = 0.408 \Delta (R_n - G) + \frac{900 u_2 (e_s - e_a)}{\Delta + \gamma (1 + 0.34 u_2)}$ <p>Where</p> <p><math>ET_c</math> Reference evapotranspiration [<math>mm\ day^{-1}</math>],  <math>R_n</math> Net radiation at the crop surface [<math>MJ\ m^{-2}\ day^{-1}</math>],  <math>G</math> Soil heat flux density [<math>MJ\ m^{-2}\ day^{-1}</math>],  <math>T</math> Mean daily air temperature at 2 m height [<math>^{\circ}C</math>],  <math>u_2</math> Wind speed at 2 m height [<math>m\ s^{-1}</math>],  <math>e_s</math> Saturation vapour pressure [<math>kPa</math>],  <math>e_a</math> Actual vapour pressure [<math>kPa</math>],  <math>e_s - e_a</math> Saturation vapour pressure deficit [<math>kPa</math>],  <math>\Delta</math> Slope vapour pressure curve [<math>kPa\ ^{\circ}C^{-1}</math>],  <math>\gamma</math> Psychrometric constant [<math>kPa\ ^{\circ}C^{-1}</math>].</p> <p><b><math>ET_c = ET_o \times K_c</math></b>                      <b><math>K_c = K_{cb} \times K_e</math></b></p> <p><small><math>ET_c</math> = Evapotranspiration of crop; <math>K_c</math> = Crop coefficient constant;  <math>K_{cb}</math> : Basal crop coefficient constant; <math>K_e</math> : Soil evaporation coefficient</small></p>		Spacing (2) / area	2'x2' (0.10 acre) & [(3'+5') x 2'] (0.20 acre) Sub- Plot.		
		Irrigation type/method	Open / furrow in sub-sub Plot		
<div style="writing-mode: vertical-rl; transform: rotate(180deg); font-weight: bold; color: green; text-align: center;">C R O P W A T E R</div>		Irrigation levels (5); schedule @ 50% Soil Moisture Depletion (SMD)	Farmers' practice (Traditional Check Basin Flood Irrigation); $ET_c$ based actual; 20%, 40% & 50% cut on actual water.		
		Treat 2 x 5 = 10	Rep : 3	Plots 30	
		2'x2' (60x60 cm) spacing		[(90+150) x 60 cms] PRS	
		T1	2 acre'' at 50% SMD in CBM FI (Traditional)	T6	2 acre'' at 50% SMD in CBM (Traditional)
		T2	FAO's mPM CWR in all furrows.	T7	FAO's mPM CWR in all paired rows.
		T3	20% reduction on T2 in alternate furrows.	T8	20% reduction on T2 in all paired rows.
		T4	40% reduction on T2 in alternate furrows.	T9	40% reduction on T2 in all paired rows.
		T5	50% reduction on T2 in alternate furrows.	T10	50% reduction on T2 in all paired rows.

41. Irrigation water accounts recorded in all four experimental crops are given in the following Table

**Table 41 . Irrigation water accounts in all four experimental crops**

Sl. No.	Particulars	Crop 1	Crop 2	Crop 3	Crop 4	Average crop <sup>-1</sup>
1	Crop season	18, May to 23, Jul. 13	01, Sept. to 06, Nov.,13	08, Jan. to 15, Mar., 13	07, Mar. to 15, May 14	May, 13 to May, 14
2	Total rainfall received (mm)	486.1	456.0	44.0	4.0	247.8
3	Effective rainfall (mm)	467.5	300.1	20.5	4.0	198.0
4	Total rain loss (mm)	18.6	155.9	20.5	0.0	48.8
5	Efficiency of rain (%)	96.2	65.8	46.5	100.0	80.0
5	Actual irrigation requirement (mm)	-167.0	-54.6	155.1	261.5	208.3
6	Potential water use by crop (mm)	300.0	245.5	148.6	301.5	248.9
7	<b>Actual water use by crop (mm)</b>	<b>300.0</b>	<b>245.5</b>	<b>148.6</b>	<b>301.5</b>	<b>248.9</b>
8	ET <sub>c</sub> / cumulative yield reduction	0	0	0	0	0



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**Table 42. Growth, productivity and quality parameters recorded under different levels of irrigation water (Average of 4 crops).**

Treatment	Branches	Branch height	TSL	Leaf wt. / plant	Shoot weight	Total biomass	No. of leaves / plant	Leaf yield ha <sup>-1</sup> crop <sup>-1</sup>	WUE	Total green biomass	LMC	LMRC
1	2	3	4	5	6	7	8	9	10	11	12	13
P <sub>1</sub> I <sub>1</sub>	9.33	121.19	1147.67	314.982	254.534	569.516	208.33	8749.570	2.442	15820.006	74.48	97.97
P <sub>1</sub> I <sub>2</sub>	11.33	117.42	1353.00	331.560	297.476	629.036	242.67	9210.074	3.700	17473.351	74.09	97.85
P <sub>1</sub> I <sub>3</sub>	9.33	111.54	1052.33	298.404	263.310	561.714	162.00	8289.066	4.163	15603.279	74.51	97.98
P <sub>1</sub> I <sub>4</sub>	9.33	120.86	1115.67	232.092	199.084	431.176	173.00	6447.052	4.317	11977.219	74.02	97.82
P <sub>1</sub> I <sub>5</sub>	9.00	125.29	1082.33	215.514	184.870	400.384	173.00	5986.548	4.810	11121.879	74.05	97.33
P <sub>2</sub> I <sub>1</sub>	18.67	93.12	1730.67	562.020	403.725	965.745	321.33	7805.896	2.179	13412.268	76.98	98.31
P <sub>2</sub> I <sub>2</sub>	19.00	85.56	1623.33	591.600	386.488	978.088	348.67	8216.732	3.301	13583.685	76.66	98.41
P <sub>2</sub> I <sub>3</sub>	19.33	87.68	1690.33	532.440	349.448	881.888	306.67	7395.059	3.714	12247.657	77.22	97.96
P <sub>2</sub> I <sub>4</sub>	15.33	102.46	1567.33	414.120	294.471	708.591	267.67	5751.713	3.851	9840.918	77.44	98.18
P <sub>2</sub> I <sub>5</sub>	17.67	100.22	1558.67	384.540	273.438	657.978	267.67	5340.876	4.292	9137.992	77.16	98.11
SEd	1.3824	29.2743	194.0338	6.4321	12.9322	15.6540	47.2821	91.1268	0.0345	285.1921	0.4980	0.2218
Signi. level	NS	NS	NS	**	**	**	NS	**	**	**	NS	NS
CD@ 5%	2.9798	11.4189	448.6506	13.7041	33.6562	38.4051	102.9113	193.2625	0.0786	746.4199	1.5465	0.5333
CV %	3.49	13.24	11.33	2.27	5.73	2.91	8.44	1.70	1.24	2.86	1.21	0.29

P1: Plantation in 2'x 2'; P2: Plantation in PRS; I1: 2 acre<sup>2</sup> level of irrigation; I2: 100% ETC; I3: 80% of ETC; I4: 60% of ETC; I5: 50% of ETC. WUE: Water Use Efficiency (Leaf yield / Ha. mm. water); LMC: Leaf Moisture Content (%); LMRC: Leaf Moisture Retention Capacity (%)

Average of 248.9 mm i.e. 2489000 lrs. ha<sup>-1</sup> crop<sup>-1</sup> (100% ETC) & 199.12 mm i.e. 1991200 lrs. ha<sup>-1</sup> crop<sup>-1</sup> (80% ETC) recorded as actual and optimum irrigation water requirement for mulberry established in alluvial soil under West Bengal condition for sustainable productivity under open irrigation furrow method. Moreover, irrigation studies require minimum of 3 years for specific recommendation to adopt at farmers' level. However, 124.45 mm i.e. 1244500 lrs. ha<sup>-1</sup> crop<sup>-1</sup> (50% ETC) tested simultaneously under micro-irrigation method in CoD<sup>2</sup>IS [Cost-effective Drum kit Drip Irrigation System] performed better in terms of high WUE and productivity for water conservation and management under limited water resources is recommended for validation under RSRs.

### **10.B.1.2. BPP (VP) 015: Validation of E3 (Efficient economic eco-friendly) WM, SH/ PM at nested units and farmers field level. (Oct., 13 to Mar., 15).**

S. Rajaram

**Objective:** To remove drudgery on work. Reduce labour and cost of production in mulberry cultivation.

**Materials & Methods:** Design & development, field trial & fine tuning of E3 WM © SH / PM for use in mulberry cultivation to carry out three different types of works namely weeding; shoot harvest & pruning and validation of the machine to find out the HRUEI [Human Resource Use Efficiency Index] separately.



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### Efficiency & HRUE of the machine



Field trial of the machine **E3 WM © SH / PM** done, required fine tuning for efficient functioning of the machine. Successfully validated and a total of 6 machines developed for use at institute / RSRSs level.

Weed mowing 21.6 hrs. acre<sup>-1</sup> weeding<sup>-1</sup> with 14.81 HRUEI.  
Shoot harvest 16.0 hrs. acre<sup>-1</sup> harvest<sup>-1</sup> with 15.00 HRUEI.  
Pruning 12.8 hrs. acre<sup>-1</sup> pruning<sup>-1</sup> with 15.00 HRUEI.

**Table 43. Break-up cost of machine.**

Sl. No.	Name of item	Cost (Rs)
1	Cost of engine (motor)	1890
2	Cost of spares (15 Nos.)	7206
3	Engineering / lathe / charges	1980
<b>Basic cost of the machine</b>		<b>11076</b>
4	Weed mowing accessories	800
5	Shoot harvest & pruning accessories	619
<b>Cost of accessories</b>		<b>1419</b>
6	Power cable (100 mts) / elec. items	2246
7	Additional accessories (spare)	800
8	Tool kit	505
<b>Cost of supporting items</b>		<b>3551</b>
<b>Total cost</b>		<b>16046</b>

Activities	Man days / hr. required / acre / crop			Work completion area m <sup>2</sup> (acre) / hr.		Savings / acre / crop	
	Manual	Machine (E3 WM © SH / PM)	HRUEI	Manual	Machine (E3 WM © SH / PM)	Man days	Amount @ Rs. 150/ md
Weeding	40 (320)	2.7 (21.6)	14.81	12.5 (0.003)	185.2 (0.046)	37.3	5595.00
Shoot harvest	30 (240)	2.0 (16.0)	15.00	12.5 (0.003)	250.0 (0.063)	28.0	4200.00
Pruning	24 (192)	1.6 (12.8)	15.00	20.8 (0.005)	312.5 (0.078)	22.4	3360.00



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### 10.B.2. MULBERRY PHYSIOLOGY SECTION

#### 10.B.2.1.PIP3469: Screening of early sprouters and late senescence mulberry accessions with better leaf yield and quality under low temperature condition. (Nov., 11 to Oct., 14)

P. K. Tewary and A. K. Misra (upto 30.09.13)

**Objective:** Screening of mulberry accessions having early sprout and late senescence characters with better leaf yield and quality under low temperature condition

#### EO1. Short-listing of mulberry varieties from mulberry germplasm bank having early sprout and late senescence characters.

A total of 149 mulberry germplasm accessions consisting of 25 exotic, 51 indigenous, 38 C-lines and 35 S-lines elite mulberry accessions were screened. Three plants of each accession were screened. Three plants of each accessions were considered. At the end of Nov., environmental temperature and relative humidity go below 20° C and 55%; leaf fall starts in most of the accessions and continued up to 2<sup>nd</sup> week of December. Date of leaf fall and sprouting of lateral buds of the accession were recorded. Days to sprout were calculated taking the period between date of leaf fall to date of sprouting. Days to senesce was counted from date of sprouting to date of senescence. Sprouting and leaf senescence behaviours of the accessions are presented in Table 43-46.

#### EO2. Studies on quality status and leaf yield of the short listed mulberry accessions.

Cuttings of short listed 13 mulberry accessions having early sprouting and late senescence were planted in experimental plot in RBD in 3 replications. After one year of establishment, physiological and biochemical parameters were studied and leaf yield data were recorded. Leaf moisture, total Chlorophyll, total soluble sugar and total soluble protein were estimated.

**Table 44. Sprouting behavior of mulberry accessions. (2011-12)**

Accessions	No. of accessions ( Days to sprout)		
	Early	Moderate	Late
Exotic (25)	10 (19-31days)	12 ( 32- 44 days)	3 ( 45- 57 days)
Indigenous (51)	19 (18-32 days)	22 (33-47 days)	10 (48-62 days)
Elite lines			
• C-lines(38)	10 (22-27 days)	17 (28-33 days)	11 (34-39 days)
• S-lines (35)	9 (19-25 days)	14 (26-32 days)	12 (33-39 days)



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**Table 45. Sprouting behavior of mulberry accessions. (2012-13)**

Accessions	No. of accessions ( Days to sprout)		
	Early	Moderate	Late
Exotic (25)	8 (18-30 days)	13 ( 31- 43 days)	4 ( 44- 56 days)
Indigenous (51)	26 (18-33 days)	20 (34-49 days)	5 (50-65 days)
Elite lines			
• C-lines(38)	9 (17-25 days)	22 (26-34 days)	7 (35-43 days)
• S-lines (35)	9 (17-24 days)	15 (25-32 days)	11 (33-40 days)

**Table 46. Senescence of mulberry accessions. (2011-12)**

Accessions	No. of accessions ( Days to senesce )		
	Early	Moderate	Late
Exotic (25)	8 (66-72 days)	14 ( 73- 79 days)	3 ( 80- 86 days)
Indigenous (51)	16 (62-70 days)	26 (71-79 days)	9 (80-88 days)
Elite lines			
• C-lines(38)	23(62-69 days)	11 (70-77 days)	4 (78-85 days)
• S-lines (35)	18 (64-72 days)	14 (73-81 days)	3 (82-90 days)

**Table 47. Senescence of mulberry accessions. (2012-13)**

Accessions	No. of accessions ( Days to senesce )		
	Early	Moderate	Late
Exotic (25)	6 (59-69 days)	14 ( 70- 80 days)	5 ( 81- 91 days)
Indigenous (51)	20 (62-70 days)	19 (71-79 days)	12 (80-88 days)
Elite lines			
• C-lines(38)	19(60-67 days)	15 (68-75 days)	4 (76-83 days)
• S-lines (35)	21 (65-72 days)	11 (73-80 days)	3 (81-88 days)

Pooled data of two years revealed 3 exotic, 4 indigenous, 3 C-lines and 3 S-lines were as early sprouter and late senescent accessions. (Table 48).

**Table 48. Short listed early sprouter and late senescent mulberry accessions.**

Accessions		Days to sprout	Days to senesce
Exotic (3 Nos.)	Phillipines, <i>M.rotundiloba</i> , Cyprus	18-31	80-91
Indigenous (4 Nos.)	Kolitha-3, Kolitha-8, Tollygunge-A, Mysore local	18-33	80-88
Elite lines			
• C-lines	C-1726,C-741,C-1540	17-27	76-85
• S-lines	S-1622,S-1662, S-1618	17-25	81-90

After one year of establishment, moisture content, pigmentation and leaf yield were studied and recorded. Leaf moisture of 13 accessions ranged from 71.43% to 80.54% with maximum moisture content in exotic accession: *Morus rotundiloba*



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(80.5%) followed by C- 1726 (80.3%). Carotenoid content was maximum in Phillipines (0.0875 mg/g fw), total soluble sugar (34.5 mg/g fw) in *Cyprus* and leaf yield in C-1540 (4507.5 kg/ha) followed by C-1726 (4215.7 kg/ha) (Table 49).

**Table 49. Physiological, Biochemical attributes and Leaf yield performance.**

Acc.	Leaf yield (kg/ha/ Oct. crop)	Leaf moisture (%)	Carotenoid (mg/g fw)	Total sol.sugar (mg/g fw)
Phillipines	2556.35	78.12	0.0875	33.07
<i>M. rotundiloba</i>	2466.65	80.54	0.0682	32.93
Cyprus	2690.90	78.24	0.0570	34.46
Kolitha-3	2825.44	71.43	0.0557	30.65
Kolitha-8	2646.05	74.11	0.0779	33.26
TollygungeA	2511.50	79.29	0.0631	28.95
Mysore local	3946.65	75.04	0.0570	33.55
S-1618	2959.99	78.06	0.0459	28.35
S-1622	3475.74	76.34	0.0441	33.46
S-1662	3879.38	78.22	0.0447	34.15
C-741	3498.17	74.81	0.0512	31.73
C-1540	4507.25	71.93	0.0584	32.11
C-1726	4215.74	80.03	0.0556	32.52
CD at 5%	0.413	NS	NS	NS

Out of 149 mulberry germplasm accessions, 13 accessions (3 exotic, 4 indigenous, 3 S lines and 3 C lines) were short listed as early sprouters (17 to 33 days) and late senescent (76 to 91 days) accessions. Elite lines C-1540 followed by C-1726 scored highest leaf yield (4507 kg/ha and 4215 kg/ha/ crop) respectively. As leaf quality parameters are comparative among the accessions, C-1540 and C-1726 can be recommended for exploitation as parents in breeding programme.

### **10.B.3. SILKWORM BREEDING AND GENETICS SECTION**

**10.B.3.1. BAI (P) 029: Large scale trial on development Id gene carrier multivoltine congenic *Bombyx mori* breed for studying the eggs nature and behavior after crossing with diapausing strains/ breeds.** (Apr., 14 to Aug., 14).

G. K. Chattopadhyay

**Objective:** To study the genetic interaction between diapausing and id gene carrier developed breed and its affect on egg character.

Among 4 hybrids tested, hybrid 3 recorded highest yield of 54.9 kg/100 dfls with silk ratio of 17.7%. The study was for finding out the genetic interaction between diapausing and *id* gene carrier developed breed and its affect on egg character. Under the study of genetic interaction between



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diapausing and *id* gene carrier developed breeds and its effect on egg character, rearing was conducted at RSRS, Kalimpong during spring season with Bi x M.Con.4 hybrid showed 92-98% hatching and 29.8 -54.8 kg cocoon yield/ 100 dfls.

Congenetic M.Con.4<sup>ld</sup> act as a diapause inhibitor. Bi x M.Con.4<sup>ld</sup> dfls prepared and supplied to RSRS Kalimpong. In spring crop, 92-98 % hatching was found without acid treatment.

### **10.B.3.2.AIB 3491: Post-Authorization Trial of silkworm hybrids in Eastern and North-Eastern India. (July 12 to Dec., 14).**

N. Suresh Kumar, Dr. G. K. Chattopadhyay and Dr. A. K. Saha.

**Objectives:** To popularize the authorized hybrids to the farmers of Eastern and North-Eastern India.

DFLs of Multi x Multi, Multi x Bi and Bi x Bi were distributed to in different seasons for rearing data was collected. Three kg cocoons each from three farmers of respective areas were purchased and sent to SCTH Malda, West Bengal for assessment of post-cocoon parameters. Feedback data from individual sericulture farmers, seed production units and reelers were collected on the specific format and data was analyzed for identification of region and season specific hybrids. As per the recommendation of the hybrid authorization committee, the hybrids which are authorized for Eastern and North-Eastern zone were recorded at farmers' level (Table 50).

**Table 50. Performance of selected silkworm hybrids for post authorization trial in the Eastern and NE zone.**

Bi x Bi		Multi x Bi		Multi x Multi	
Crop	Hybrid	Crop	Hybrid	Crop	Hybrid
Falguni (Spring)	Gen3 x Gen2 SLD4 x SLD8 NB18 x P5	Shravani (June-July)	M.Con.1 x M.Con.4 N x M.Con.4 N x M12(W)	Shravani (June-July)	M.Con.1 x M.Con.4 N x M.Con.4 N x M12(W)
Agrahayani (Autumn)	Gen3 x Gen2 SLD4 x SLD8 NB18 x P5	Aswina (Sept.) Bhaduri (August)	M.Con.1 x M.Con.4 N x M.Con.4 N x M12(W)	Aswina (Sept.) Bhaduri (Aug)	M.Con.1 x M.Con.4 N x M.Con.4 N x M12(W)
-	-	Agrahayani (Autumn)	M.Con.1 x B.Con.4 M.Con.4 x B.Con.4 N x NB4D2	-	-

The bivoltine hybrids viz., Gen3 x Gen2, SLD4 x SLD8 and FC1 x FC2 with NB18 x P5 as control and the multivoltine x bivoltine hybrids viz., M.Con.1 x B.Con.4, M.Con.4 x B.Con.4 with N x NB4D2 as control and multivoltine hybrids viz., Nistari x M.Con.4, M.con.1 x M.Con.4 with Nistari x M12 (w) were tested with the farmers of West Bengal, Jharkhand, Odisha, Chattisgarh, Manipur, Assam, Meghalaya, Mizoram, Nagaland and Sikkim for two years covering all the commercial crops of the respective states. Yield performance of different bivoltine hybrids, multi x bi hybrids and multi x multi hybrids in West Bengal (Table 51 - 53).



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**Table 51. Performance of new multi x bi hybrids in West Bengal.**

Year	Season	Hybrid					
		M.Con.1 x B.Con.4		M.Con.4 x B.Con.4		N x NB4D2	
		Dfls	Yield/ 100 dfls	Dfls	Yield/ 100 dfls	Dfls	Yield/ 100 dfls
2012-13	Falguni	--	--	10300	--	--	--
	Agrahayani	11000	62.89	24550	65.53	40000	55.28
2013-14	Falguni	37450	43.13	24900	47.49	21200	39.69
	Baishaki	36600	45.75	41300	47.66	19400	41.99
	Agrahayani	56550	41.87	29000	45.27	16700	41.04
2014-15	Falguni	43800	47.78	23300	51.57	20600	45.16
	Baishaki	41800	46.14	39500	48.72	28650	45.04
<b>Total/Average</b>		<b>227200</b>	<b>47.92</b>	<b>192850</b>	<b>51.04</b>	<b>146550</b>	<b>44.70</b>

**Table 52. Performance of new multivoltine x multivoltine hybrids in West Bengal.**

Year	Season	Hybrid					
		M.Con.1x M.Con.4		Nistari x M.Con.4		N x M12(w)	
		Dfls	Yield/ 100 dfls	Dfls	Yield/ 100 dfls	Dfls	Yield/ 100 dfls
2013-14	Jaistha	12000	36.39	16700	34.13	6350	28.05
	Shravani	2900	33.65	6250	36.28	10850	32.60
	Bhaduri	30220	20.50	27300	26.00	10400	23.50
	Aswina	26790	30.91	9210	33.14	20300	31.37
2014-15	Jaistha	5000	33.09	4500	32.94	18000	30.15
	Shravani	--	--	--	--	13000	36.22
	Bhaduri	19600	24.02	24000	22.21	4800	22.09
	Aswina	7000	36.57	--	--	9000	30.77
<b>Total/Average</b>		<b>103510</b>	<b>30.73</b>	<b>87960</b>	<b>30.78</b>	<b>92700</b>	<b>29.34</b>

**Table 53. Performance of new Bivoltine hybrids in West Bengal.**

Year	Season	Hybrid			
		Gen3 x Gen2		NB18 x P5	
		Dfls	Yield/ 100 dfls	Dfls	Yield/ 100 dfls
2013-14	Falguni	18000	70.68	6700	59.60
	Ahrahayani	30600	30.59	7250	34.51
2014-15	Falguni	19300	49.74	4400	48.74
<b>Total/Average</b>		<b>67900</b>	<b>50.34</b>	<b>18350</b>	<b>47.62</b>

In North Eastern states only the bivoltine hybrids viz., Gen3 x Gen2, SLD4 x SLD8, FC1 x FC2 with the control NB18 x P5 were tested. The yield performance of different bivoltine hybrid shows in the Table 54.



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**Table 54. Performance of bivoltine hybrids in NE states**

Unit	Dfls	Summer crop,13		Autumn crop, 13			Summer crop,14		
		Combi-nation	Yield/100 dfls (kg)	Dfls	Combi-nation	Yield/100 dfls (kg)	Dfls	Combi-nation	Yield/100 dfls (kg)
RSRS, Jorhat	4000 4000 2000	SLD4 x SLD8 Gen3 x Gen2 NB18 x P5	27.26 29.37 22.93	8000 2000	FC1 x FC2 NB18 x P5	44.16 44.35	8000 2000	SLD8 x SLD4 NB18 x P5	38.70 37.00
<b>Total/ Avg</b>	<b>10000</b>		<b>26.52</b>	<b>10000</b>		<b>44.26</b>	<b>10000</b>		<b>37.85</b>
REC, Agartala	600 600 300	SLD4 x SLD8 Gen3 x Gen2 NB18 x P5	38.20 30.20 41.00	1200 300 250	FC1 x FC2 NB18 x P5	30.00 37.30	1200 300	SLD4 x SLD8 NB18 x P5	30.00 37.30
<b>Total/ Avg</b>	<b>1500</b>		<b>36.47</b>	<b>1750</b>		<b>33.65</b>	<b>1500</b>		<b>33.65</b>
REC, Aizawl	1000 1000 500	SLD4 x SLD8 Gen3 x Gen2 NB18 x P5	45.00 43.00 33.00	2000 500	FC1 x FC2 NB18 x P5	48.25 43.70	2000 500	SLD8 x SLD4 NB18 x P5	47.02 41.50
<b>Total/ Avg</b>	<b>2500</b>		<b>40.33</b>	<b>2500</b>		<b>45.98</b>	<b>2500</b>		<b>44.26</b>
REC, Dimapur	200 100	Gen3 x Gen2 NB18 x P5	29.00 25.25	400 100	FC1 x FC2 NB18 x P5	0.75 20.00	400 100	SLD8 x SLD4 NB18 x P5	27.00 24.00
<b>Total/ Avg</b>	<b>300</b>		<b>27.13</b>	<b>500</b>		<b>10.38</b>	<b>500</b>		<b>25.5</b>
REC, Imphal	1000 1000 500	SLD4 x SLD8 Gen3 x Gen2 NB18 x P5	40.43 36.44 36.79	2000 500	FC1 x FC2 NB18 x P5	47.02 42.84	2000 500	SLD8 x SLD4 NB18 x P5	48.50 43.70
<b>Total/ Avg</b>	<b>2500</b>		<b>37.89</b>	<b>2500</b>		<b>44.93</b>	<b>2500</b>		<b>46.1</b>
REC, Shillong	1000 1500	SLD4 x SLD8 Gen3 x Gen2	31.38 26.64	2000 500	FC1 x FC2 NB18 x P5	50.80 48.62	2000 500	SLD8 x SLD4 NB18 x P5	45.35 47.21



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Total/ Avg	2500		29.01	2500		49.71	2500		46.28
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In other Eastern states only the bivoltine hybrids viz., FC1 x FC2 with the control NB18 x P5 and multi x bi hybrid M.Con.4 x B.Con.4 with the control hybrid, N x NB4D2 were tested. Yield performance of different bivoltine hybrids were:

- **At Odisha:** A total of 3400 dfls of M.Con.4 x B.Con.4 were tested at farmers level and recorded an average yield of 40.8 kg/100 dfls and 1800 dfls of the control hybrid, N x NB4D2 recorded an average yield of 32.7 kg/100 dfls.
- **At Chattisgarh:** A total of 800 dfls of M.Con.4 x B.Con.4 were tested at farmers level and recorded an average yield of 48 kg/100 dfls and 400 dfls of the control hybrid, N x NB4D2 recorded an average yield of 40 kg/100 dfls.
- **AT Jharkhand :** A total of 2000 dfls of M.Con.4 x B.Con.4 were tested at farmers level and recorded an average yield of 39 kg/100 dfls and 1000 dfls of the control hybrid, N x NB4D2 recorded an average yield of 33.7 kg/100 dfls. During Autumn crop, a total of 2000 dfls of FC1 x FC2 were tested at farmers level and recorded an average yield of 31.9 kg/100 dfls and 1000 dfls of the control hybrid, NB18 x P5 recorded an average yield of 31kg/100 dfls.
- **At Sikkim:** A total of 2500 dfls of Gen3 x Gen2 were tested at farmers level and recorded an average yield of 35 kg/100 dfls. During Autumn crop, 2000 dfls of FC1 x FC2 were tested and recorded an average yield of 36 kg/100 dfls and 500 dfls of NB18 x P5 were tested and recorded an average yield of 33kg/100 dfls .

Based on the overall performance at farmers field, during favourable seasons i.e. Agrahayani, Falguni and Baishaki, it was recommended to rear the multi x bi hybrids, M.Con.1 x B.Con.4 and M.Con.4 x B.Con.4. During unfavourable seasons i.e. Shravani, Jaistha, Bhaduri and Aswina, rearing of multivoltine hybrids, Nistari x M.Con.4 and M.Con.1 x M.Con.4 in West Bengal and Jharkhand states were recommended. With regard to bivoltine hybrids, Gen3 x Gen2 in West Bengal and Jharkhand while in North Eastern states, FC1 x FC2 were recommended.

### **10.B.3. SILKWORM PHYSIOLOGY & RTI SECTION**

#### **10.B.3.1.AIP 3472:Standardization and determination of temperature tolerance potentiality in different developmental stages of silkworm, *Bombyx mori* L. (Sept.,11 to Aug., 14).**

A. K. Saha, T. Datta (Biswas) and G. K. Chattopadhyay.

**Objectives:** Determination of stage specific effect of different temperature (30-35°C) and humidity (>90%) on silkworm rearing. Determination of temperature and humidity tolerance potentiality based on 50% lethality and period of exposure for a specific instar.



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**SILKWORM BREEDS:** B.Con.4, SH6, NB4D2 and M.Con.4, Sarupat, Nistari

**Treatment:** 32 & 35± 1°C temp with > 90% relative humidity (RH) were applied at each Instar during photophase and the larvae were kept under congenial temperature and RH during Scotophase. Two sets were kept at each instar for each breed for providing thermal stress including and excluding moulting period during 1<sup>st</sup> to 4<sup>th</sup> instar. At 5<sup>th</sup> instar one set was provided stress up to initiation of larval maturation and other set up to the period when 80% of the larvae got matured. After application of treatment at each instar, larvae were reared providing congenial temperature and RH for rest of the larval period. Matured larvae were kept in the Chandrakie for spinning at congenial environmental condition. On 6<sup>th</sup> day of spinning cocoons were harvested and data recorded.

**Experiment: E01:** Determination of stage specific effect of different temperature (30-35°C) and relative humidity (>90%) on silkworm rearing and temperature and humidity tolerance potentiality based on 50% lethality and period of exposure for a specific instar.

### **Effect of thermal stress on bivoltine breeds:**

- Congenic breed B.Con.4 registered more than 50% survival at each instar with instar specific thermal stress of 32±1°C with 90±1% RH both including and excluding moulting periods.
- With thermal stress of 35 ±1°C with 90±1% RH (without moulting period) survival was below 50% when treatment was applied during 4<sup>th</sup> & 5<sup>th</sup> Instars only.
- In SH6, survival ranged between 28 to 51% with thermal stress of 32 ±1°C with 90±1% RH.
- Survival was noted below 50% at each instar when thermal stress of 32 ±1°C with 90% RH was applied both with and without moulting period except 51% survival during 4<sup>th</sup> instar without moulting period.
- Survival % was found comparatively higher when treatment was applied including moulting period in comparison to excluding moulting period.
- NB4D2 failed to survive with thermal stress of 35 ±1°C with 90% RH.

### **Effect of thermal stress on multivoltine breeds:**

- Congenic breed M.Con.4 and Nistari registered tolerance even at 35 ±1°C with 90% RH both including and excluding moulting period.
- Survival in M.Con.4 ranged between 52.5% and 69% including moulting period and 73% to 81% excluding moulting at 35 ±1°C with 90% RH.
- In Nistari, survival was ranged between 50% and 72% including moulting period and 66.6% to 83% excluding moulting period at 35±1°C with 90% RH, respectively.
- Survival registered in Sarupat 3.5% to 6.02% including moulting period and between 21% to 33% excluding moulting period at 35 ±1°C with 90% RH.



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Amongst the bivoltine breeds tested, congenic breed B.Con.4 registered thermo-tolerance capability which may be utilized in breeding programme. Congenic multivoltine breed M.Con.4 also registered thermo-tolerance capability along with the traditional breed Nistari (with low production potentiality). NB4D2 was found most susceptible amongst the bivoltines. Sarupat was also found severely affected with thermal stress > 32 °C. Effect of thermal stress including moulting period was found more severe in comparison to stress without moulting period.

**10.B.3.2.AIE3454: Evaluation of elite bivoltine silkworm germplasm under different agro climatic conditions: All India Silkworm Germplasm Evaluation Programme Phase-II.** [Networking collaborative project of CSGRC,Hosur]. (Sept., 11 to Aug., 14).

M. K. Singh , R. Bhutia (up to June, 2014), C. Maji (from July, 2014) and U. K. Bandyopadhyay (up to June, 2014).

**Objectives:** Identify the suitability of bivoltine silkworm germplasm for specific agro climatic area. Identify bivoltine silkworm germplasm which have a wider adaptability to varied climatic condition. Identify the potential germplasm as parent for silkworm hybridization programme suitable for different agro climatic condition

Twelve bivoltine accessions viz., BBE-164, BBE-329, BBE-268, BBE-202 BBE-266, BBE-225, BBI-338, BBE-263, BBE-216, BBI-348 along with SK6 (local control) and BBI-290 ( national control) were reared during spring and autumn crop following standard rearing practices with three replications. Three years pooled data on rearing performance during spring and autumn season showed highest ERR (no.) in BBI-348 (7878) followed by BBE-216 (7689). However, ERR (wt.) was highest in SK6 (13.4 g) followed by BBI-348 (13.2 g) and shell ratio was highest in BBE-263 (19%) followed by BBE-216 (18.7%). Evaluation index of the accessions revealed that the highest EI in BBE-268 (59.98) followed by BBI-348 (57.8), BBI-338 (56.9) (Table 55 & 56).

**Table 55. Rearing performance of the accession (three years pooled data)**

Accession nos.	Wt. of 10 mature larvae (g)	ERR/10000 larvae		SCW (g)	SSW (g)	Shell (%)
		No.	Wt. (kg)			
BBE -164	38.66	7578.00	12.51	1.65	0.30	18.06
BBE-202	38.88	7261.00	11.76	1.62	0.28	17.62
BBE-216	39.83	7689.00	12.34	1.60	0.30	18.73
BBE-225	39.31	7253.00	11.69	1.61	0.29	18.24
BBE-263	42.33	7683.00	12.57	1.64	0.31	<b>19.02</b>
BBE-266	39.64	6936.00	10.66	1.54	0.28	18.32
BBE-268	38.75	7464.00	12.11	1.62	0.29	18.06
BBE -329	39.80	7450.00	12.17	1.64	0.29	18.11
BBI-338	41.15	7122.00	12.08	1.70	0.32	18.61
BBI-348	39.81	7878.00	13.17	1.67	0.31	18.68
BBI-290	40.98	7661.00	12.66	1.65	0.30	18.10
SK-6	42.14	7684.00	13.36	1.73	0.30	17.44



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**Table 56. Multiple Evaluation Index of the accession.**

Accession nos.	Wt. of 10 mature larvae (g)	ERR/10000 larvae		SCW (g)	SSW (g)	Shell (%)	EI
		No.	Wt.(kg)				
BBE -164	53.83	36.19	46.52	53.60	51.05	37.93	46.52
BBE-202	42.12	46.18	43.36	42.01	40.96	45.55	43.36
BBE-216	49.22	46.03	47.11	48.75	46.01	45.55	47.11
BBE-225	30.75	48.97	39.26	27.54	43.48	45.55	39.26
BBE-263	49.73	56.46	50.15	47.91	43.48	53.18	50.15
BBE-266	57.62	59.40	54.12	54.37	46.01	53.18	54.12
BBE-268	57.82	63.81	59.98	51.21	58.62	68.43	60.00
BBE -329	42.42	33.70	41.63	43.06	51.05	37.93	41.63
BBI-338	37.44	55.14	56.95	47.49	76.27	68.43	56.95
BBI-348	64.60	62.48	57.83	62.87	46.01	53.18	57.83
BBI-290	56.81	51.91	50.19	55.71	40.96	45.55	50.19
SK-6	57.62	39.72	52.89	65.47	56.10	45.55	52.89

**General Observation:** During Spring **BBI 0348** ranked 1<sup>st</sup> at Berhampore and 3<sup>rd</sup> at Kalimpong; **BBE 0268** ranked 1<sup>st</sup> at Jorhat and 3<sup>rd</sup> at Berhampore ; **BBI 037** ranked 1<sup>st</sup> at KPG and 2<sup>nd</sup> at Jorhat whereas **BBI 0338** ranked 4<sup>th</sup> at Kalimpong and 5<sup>th</sup> at Berhampore. During Autumn **BBI 0348** ranked 1<sup>st</sup> at Berhampore and 3<sup>rd</sup> at Kalimpong; **BBE 0216** ranked 2<sup>nd</sup> both at Berhampore and Jorhat; **BBE 0266** 2<sup>nd</sup> at Kalimpong and 4<sup>th</sup> at Berhampore whereas **BBI 0338** 4<sup>th</sup> at Kalimpong and 5<sup>th</sup> at Jorhat.

The accessions performed better than the national and local control can be used as parents in breeding programmes.

### 10.B.4.BIO-TECHNOLOGY SECTION

#### 10.B.4.1.BPR(P) 022: Identification of DNA markers associated with bacterial leaf spot resistance in mulberry (*Morus spp.*). (Apr., 13 to Mar., 15).

Rita Banerjee and Lalitha N.

**Objectives:** Confirmation of bacterial leaf spot (BLS) reaction of the segregating progeny under field/artificial inoculums study. Utilization of SSRs for BLS resistance analysis. Identification of putative DNA tags associated with BLS resistance.

#### Establishment of bacterial leaf spot specific segregating populations:

In order to identify reaction pattern and associated inheritance of the disease in mulberry, a segregating BLS specific population of 175 parents derived from the control crosses of *Morus multicaulis* (as resistant donor) with three susceptible recipients (KPG-1, C-2028 and S-1) was established in the experimental field of the Institute in ARBD under seven blocks each with 4 sets of parents for natural inoculums based study. Besides, a clonal set of said population along with all four parents was also established for artificial inoculums based durability assessment of the BLS.



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### Evaluation of segregating population for bacterial leaf spot resistance in natural and artificial epiphytotics:

Four rounds of disease scoring was conducted with the onset of natural incidence of BLS coincided with the commercial silkworm rearing seasons of Baisakhi (June - July) and Shrabani (Aug. - Sept.) crop. Three plants per clone of each progeny were studied four times at 10 days interval after 20 days of basal pruning. *M. multicaulis* exhibited less incidence and severity. Maximum BLS severity 20.1 and 19.1 was observed in KPG-1, besides; S-1 and C-2028 indicated susceptible disease reaction.

**Table 57. Mulberry clones used as parents and their mean responses to BLS during 2013 and 2014.**

Parent	Mean response to BLS			
	Disease incidence <sup>a</sup>		Disease severity <sup>b</sup>	
	2013	2014	2013	2014
<i>M. multicaulis</i>	4.5±0.9 <sup>c</sup>	2.9±0.1	4.5±1.1	2.5±0.05
KPG-1	54.3±7.3	33.9±1.9	20.1±2.06	19.1±0.9
S-1	38.1±4.4	25.2±3.7	17.3±1.2	17.2±0.4
C-2028	50.1±3.6	31.4±2.4	19.9±2.8	18.1±0.5

<sup>a</sup> Disease incidence is on a per plant basis is the average for 3 branches per plant of three clones per 5 clones. <sup>b</sup> Disease severity is the percentage of plants infected with BLS, and is the average for 3 branches per plant of three clones per 5 clones. <sup>c</sup> Standard error

BLS severity was recorded for the pseudo F<sub>2</sub> (F<sub>1</sub>) mapping progenies and population mean for each cross (Table 58).

**Table 58. Range and mean of pseudo F<sub>2</sub>(F<sub>1</sub>) progenies to BLS under field environment during 2013 and 2014**

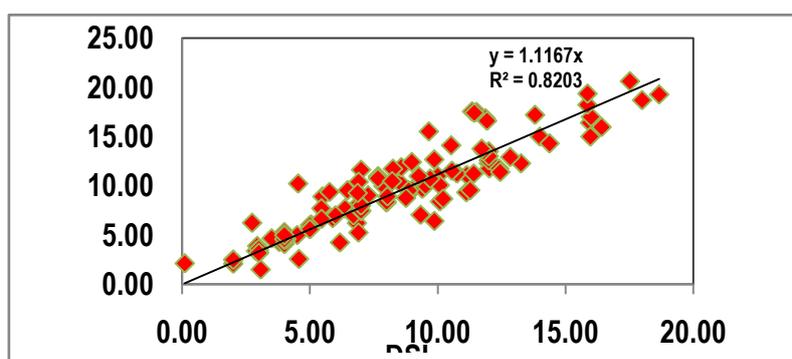
Cross	Year tested	No. of F <sub>1</sub> lines tested	Response to BLS			
			Disease incidence		Disease severity	
			Range	Mean	Range	Mean
<i>M. multicaulis</i> x KPG-1	2013	65	4.3-45.7	20.9±1.4 <sup>a</sup>	1.5-18.8	9.7±0.5
<i>M. multicaulis</i> x KPG-1	2014	65	4.7-17.1	17.02±1.2	3.9-22.7	9.5±0.5
<i>M. multicaulis</i> x S-1	2013	55	6.4-69.2	31.8±1.8	3.7-25.5	13.1±0.6
<i>M. multicaulis</i> x S-1	2014	55	6.02-47.3	17.6±1.2	4.8-25.5	10.3±0.5
<i>M. multicaulis</i> x C-2028	2013	55	4-6-67.8	32.5±2.0	1.5-24.0	12.6±0.6
<i>M. multicaulis</i> x C-2028	2014	55	5.0-41.2	17.2±1.1	3.7-21.3	8.8±0.4

<sup>a</sup> Standard error

Durability of BLS disease reaction of pseudo F<sub>2</sub> (F<sub>1</sub>) lines was tested in artificially inoculated potted plant assay showed significant association (r = 0.82) correlation between DSI of field and inoculum based study further confirm the durability BLS disease resistance/susceptibility of the pseudo F<sub>2</sub>(F<sub>1</sub>) lines at 95% confidence level (Fig.10).



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**Fig. 10.** Relationship between the mean BLS disease severity index (DSI) of field environment and artificial inoculum based study.

### Segregation genetics of bacterial leaf spot resistance in three crosses:

Number of resistant genes was estimated using chi-square analyses by classifying the *pseudo*-F<sub>2</sub> (F<sub>1</sub>) lines in two categories: resistant and intermediate-susceptible (Table 59).

**Table 59.** Frequencies and  $\chi^2$  analysis for pseudo F<sub>2</sub>(F<sub>1</sub>) lines tested.(2013-14)

Cross	Number of pseudo F <sub>2</sub> (F <sub>1</sub> ) lines <sup>a</sup>		2 and P values <sup>b</sup>		
	Resis-tant	Intermediate-Susceptible	3 genes	4 genes	5 genes
<i>M. multicaulis</i> x KPG-1	6	59	0.08,P>0.5	2.79,P=0.08	13.9, P<0.01
<i>M. multicaulis</i> x S-1	2	53	2.64,P>0.1	0.16,>0.5	0.44,P>0.5
<i>M. multicaulis</i> x C-2028	1	54	4.28,P<0.05	1.07,<0.5	0.06,P>0.5

<sup>a</sup> PseudoF<sub>2</sub> (F<sub>1</sub>) lines with 6 DSI in *M.multicaulis* xS-1and 5 DSI in *M.multicaulis*xKPG-1, *M. multicaulis* x C-2028 were considered to be resistant. Remaining lines were grouped in the intermediate-susceptible category. <sup>b</sup> Ratios used for 2 analyses are 0.897:0.103; 0.952:0.048 and 0.977:0.023, which are expected for independent segregations of 3, 4 and 5 genes, respectively.

Based on the genetic analysis, it appeared most likely that at least three additive genes are segregated for BLS resistance in the population, although the possibility of four genes could not be rejected by the chi-square analysis.

### Assessment of mapping population for foliage yield and other quantitative traits:

Significant variability was observed for all measured agronomic traits and foliage biomass (Table 60).



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**Table 60. Disease and leaf biomass of identified promising lines derived from segregating mapping population.**

Progeny/ Parent	Disease reaction			Leaf biomass		Expected increment	
	DSI	Grade	<S-1(%)	Actual (g.plant <sup>-1</sup> )	Projected (kg.ha <sup>-1</sup> .yr <sup>-1</sup> )	>S-1(%) > S1635 (%)	
HY-1	7.8	MR	59.38	321.70	44679	41.8	6.4
HY-2	8.0	MR	58.33	333.80	46360	47.2	10.4
HY-3	8.5	MR	55.73	348.60	48415	53.7	15.3
HY-4	9.4	MR	51.04	344.70	47874	51.9	13.9
HY-5	7.5	MR	60.94	378.50	52568	66.8	25.2
HY-6	7.3	MR	61.98	360.50	50068	58.9	19.2
HY-7	4.5	R	76.56	384.70	53429	69.6	27.2
HY-8	8.0	MR	58.33	398.50	55346	75.7	31.8
HY-9	6.0	R	68.75	309.70	43013	36.6	2.4
HY-10	6.2	R	67.71	328.80	45665	44.9	8.7
S-1	19.2	S		226.81	31501		
S-1635*				302.40	41999		
<i>M. multicaulis</i>	2.7	R					

Identified promising lines (BLS resistance/foilage biomass) were utilized sib-mating for development of advanced breeding generation. It is worth mentioning that ~ 14 F<sub>1</sub> lines indicated transgressive segregation for more leaf biomass (Table 59). Besides, these promising lines also showed resistant/moderately resistance BLS response under natural field condition with expected incremental foliage of about ~6.4 -31.8% (based on projected value) over the ruling cultivar S-1635.

### DNA profiling of parents/ selected progeny using SSR primers:

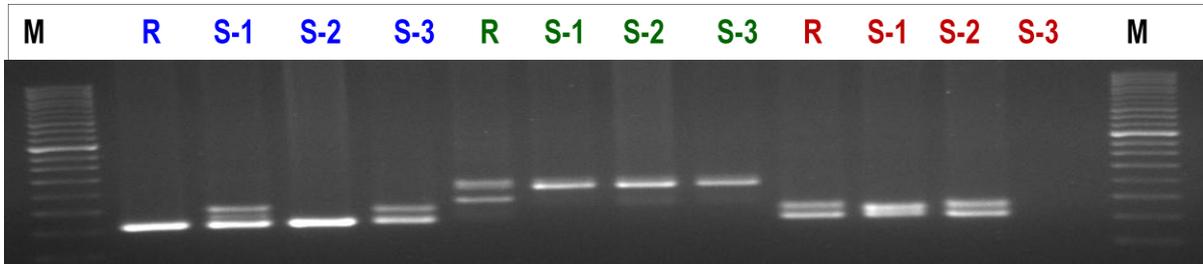
DNA was extracted from leaf samples of parental as well as selected (~ 70) contrast responsive progeny lines, quantity and quality of the DNA were tested by 0.8% agarose gel electrophoresis and 260:280 absorption ratio by spectrophotometry, respectively. The obtained DNA yield ranges between 1.6 to 2µg per mg fresh mass.



**Fig.11.** 0.8% Agarose gel of genomic DNA for (a) 6 parental and (b) 17 progenies of bacterial leaf spot specific segregating lines.

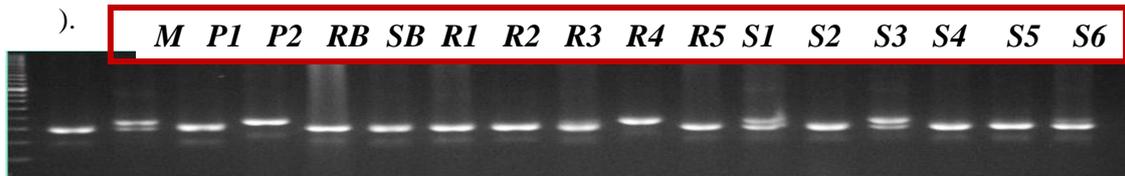
About 16 mulberry specific microsatellite markers (developed by CCMB and some others) were tested on segregating progenies for finding any new putatively linked marker(s). Altogether 6 out of 16 tested SSR primers indicated polymorphism among 4 parental lines (*M. multicaulis* resistant parent; KPG-1, S-1 and C-2028: susceptible parents).

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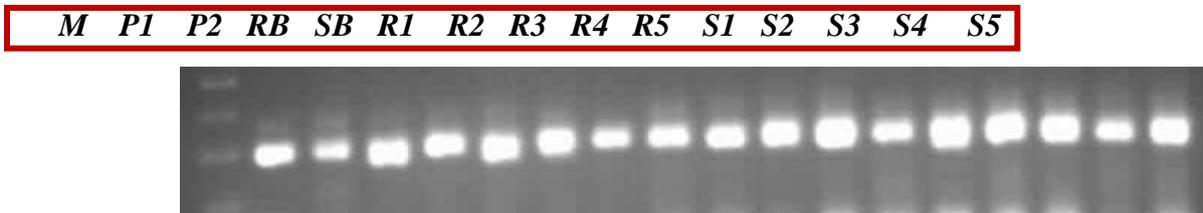


**Fig. 12.** DNA profiling of four parents contrast responsive to bacterial leaf spot resistance using three promising SSR markers (MM-37, MM-177 and NGS 262) M:Marker; R: *M. multicaulis*; S-1:KPG-1, S-2:S-1 and S-3: C-2028.

Two SSR primers generated DNA amplification products showed unique band of 200 and 250 bps under 3% agarose gel for five resistance and seven susceptible progenies (out of 9 each of contrasting progenies derived from the cross of *M. multicaulis* x S-1) (Fig. 14).



**Fig.13.** NGS\_MUL\_262 on parents (P1 & 2) and BLS responsive resistance and susceptible progenies, RB resistant bulk, SB susceptible bulk R1-5= resistant progeny; S1-8 = susceptible progeny; P1=resistant parent (*M.multicaulis*); P2 =susceptible parent (S-1); M=marker.



**Fig. 14.** MM\_MUL\_72 on parents (P1 & 2) and 5& 8 BLS responsive resistance and susceptible progenies, RB resistant bulk, SB susceptible bulk R1-5= resistant progeny; S1-8= susceptible progeny; P1=resistant parent (*M. multicaulis*); P2 =susceptible parent (KPG-1); M=marker

Results suggested quantitative nature of BLS resistance with possible involvement of at least three additive gene actions. Developed an advance breeding lines by sib-mating of promising pseudoF2 (F1) progenies. Identification of a few transgressive progenies from *Multicaulis* (resistance) with x S-1/ KPG-I and C-2028 crosses having better yield potential than superior parent(s) along with BLS resistance. Identified a few SSR markers for possible use as molecular tags for BLS disease reaction of mulberry plants.

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### 10.B.5. SILKWORM PATHOLOGY SECTION

#### 10.B.5.1.BAR(PS)004: Testing of immunogens for prevention of silkworm diseases in *Bombyx mori* L.(Jul., 13to June, 14).

S. Chakrabarty and A. K. Saha.

**Objectives:** Formulation of a synergistic preparation of immunogen with eco-friendly, cost effective bio-molecules for immunization of silkworm, *Bombyx mori* to control silkworm diseases. Increase the cocoon productivity.

**E01: Testing of synergistic effect of three immunogens for formulation of effective immunogen against silkworm pathogens:** Seven formulated combinations ( 1:1:1, 1:1:2, 1:2:2, 1:2:1, 2:2:1, 2:1:2 and 2:1:1) of Proline, Nicotinic acid and Ascorbic acid ~ 20mg / ml was tested for synergistic effect against silkworm pathogens namely Bacterial suspension, Nuclear Polyhedrosis virus (*BmNPV*) and *Beauveria bassiana* causing common silkworm diseases. Data have been recorded and analyzed statistically.

**E02: Testing of effective immunogen formulations in susceptible silkworm breed.** Most effective three immunogen formulations were shortlisted and tested on susceptible silkworm breeds namely S2, O, G and CB5 along with M6DP(C) as ruling breed used for hybrid seed preparation and Nistari as control. Data recorded and analyzed statistically.

**E03: Assessment of reeling and crop performance and post cocoon parameters in suitable breeds / hybrids.** Reeling parameters such as filament length, non-breakable filament length and denier were recorded on silkworm breeds/ hybrids in normal condition and results were analysed statistically.

**E04: Determination of shelf life of effective formulation of Bio-product.** Assessment of shelf life of new formulation of immunogen is under process by freezing from - 5°C to 25°C for one month to six months.

The eco-friendly, cost effective and synergistic formulation of bio-molecules increased effective rate of rearing thereby increased the cocoon productivity.

**Table 61.** Pool data analysis for effect of treatments (immunogens) on susceptible, ruling and control breeds are depicted below (V wt- 5<sup>th</sup> stage larval weight in g, ERR-Effective Rearing Rate, SCW- Single Cocoon wt in g, SSW- Single Shell Weight in g, FL-Filament length in mtr., NBFL- Non Breakable Filament Length in mtr., Dr - Denier, Index- Smith Index, Con- Control, mean- arithmetic mean and SD - standard deviation, Treat - Treatment and HC- Healthy Control):

Treat-ments	V wt. (g)	ERR No.	SCW (g)	SSW (g)	ERR wt. (g)	FL (m)	NBFL (m)	Dr	Smith Index
Treat-I	2.418	79.150	1.037	0.129	79.089	381	327	2.293	1
Treat-II	2.381	76.450	1.045	0.134	75.890	376	318	2.298	4
Treat-III	2.393	79.950	1.012	0.133	78.929	374	315	2.332	2
HC	2.450	79.950	1.036	0.133	77.660	359	301	2.337	3
Mean	2.410	78.880	1.033	0.130	77.890	373	316	2.310	
SD	0.03	1.44	0.01	0.0	1.28	8.1	9.27	0.02	
Criterion 1	3	3	3	3	3	3	3	3	
Criterion-2	10	10	6	6	6	6	6	6	



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**Table 62.** Pool data analysis for effect of immunogens on susceptible, ruling and control breeds. (July, 2013 to Jan,14)

Breeds	V wt. (g)	ERR No.	SCW (g)	SSW (g)	ERR wt. (g)	FL (m)	NBFL (m)	Dr	Smith Index
M6DPc	2.000	76	0.920	0.111	61.452	336	286	2.184	5
G	2.508	87	1.081	0.145	81.095	366	330	2.424	1
CB5	2.575	82	1.111	0.144	87.252	394	328	2.268	3
O	2.608	80	1.059	0.142	89.666	427	365	2.284	2
S2	2.253	84	0.942	0.121	80.328	354	337	2.132	4
Nistari	1.882	96	0.811	0.092	73.363	281	256	2.173	6
Mean	2.300	84.71	0.987	0.13	78.86	360	318	2.24	
SD	0.28	6.24	0.11	0.02	9.38	45.52	35.65	0.10	

**Table 63.** Statistical analysis for effect of treatments (immunogens) on susceptible, ruling and control breeds (Mach, 14)

Treat.	V wt. (g)	ERR No.	SCW (g)	SSW (g)	ERR wt. (g)	FL (m)	NBF L (m)	Dr	Smith Index
T-I	2.685	99.75	1.177	0.157	117.703	425	372	2.69	3
T-II	2.896	99.50	1.171	0.154	120.035	419	395	2.67	2
T-III	2.914	99.75	1.165	0.166	121.455	436	436	2.67	1
HC	2.919	98.50	1.157	0.161	120.580	419	391	2.70	4
Mean	2.85	99.38	1.167	0.16	119.94	424	398	2.68	
St.dev.	0.10	0.52	0.01	0.00	1.39	6.84	23.28	0.02	
Criterion 1	3	3	3	3	3	3	3	3	
Criterion 2	10	10	6	6	6	6	6	6	

**Table 64.** Statistical analysis for effect of treatments (immunogens) is conducted on susceptible, ruling and control breeds are depicted below (June, 14).

Treat	V wt. (g)	ERR No.	SCW (g)	SSW (g)	ERR wt. (g)	FL (m)	NBFL (m)	Dr	Smith Index
T I	2.685	99.75	1.177	0.157	117.703	425	372	2.69	3
TII	2.896	99.50	1.171	0.154	120.035	419	395	2.67	2
TIII	2.914	99.75	1.165	0.166	121.455	436	436	2.67	1
HC	2.919	98.50	1.157	0.161	120.580	419	391	2.70	4
Mean	2.85	99.38	1.167	0.16	119.94	424	398	2.68	
St.dev.	0.10	0.52	0.01	0.00	1.39	6.84	23.28	0.02	
Criterion 1	3	3	3	3	3	3	3	3	
Criterion 2	10	10	6	6	6	6	6	6	

Results suggested the eco- friendly, cost effective and synergistic formulation of bio-molecules increased effective rate of rearing thereby increased the cocoon productivity.



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### 10.B.5.2. BAR (VP) 009: ‘Ghar Sodhon’ a fumigant room disinfectant for silkworm disease management. (Apr., 14 to Mar., 15).

S. Chakrabarty , A. K. Saha, T. Dutta Biswas, D. Pandit, S. Chatterjee, A. K. Dutta, Incharge, REC Rajmahal; Deputy Directors, DoT(Seri), Murshidabad, Birbhum, Nadia and Malda.

**Co-ordinators:** Shri Bijoy Mukherjee, Addl. Director, DoT(Seri), Govt. of West Bengal.

**Objectives:** To validate the technology ‘Ghor sodhon’ for room disinfection using fumigant chemicals at different Sections of the Institute where silkworm rearing is conducted. Disease management in silkworm crops.

Total 283 seed / commercial farmers and 17 CSB/DOS Farms have been covered under programme in West Bengal, Jharkhand, Jorhat, Ranchi and Odisha and their performance showed in Table 65.. It increased the cocoon production ~ 3.90 kg against control 42.73 kg/ 100 dfls . Benefit cost ratio is 3.42 over 5% Bleaching powder (existing room disinfectant) and 3.48 over Sanitech / Serichlor20. It has been observed that ‘Ghar sodhon’ is better (ERR- 86.0%) than **Sanitech** (ERR- 83.67%), **5 % Bleaching powder solution** (ERR-82.33%) and **Seriswachh** (ERR=80.33%).

**Table 65.** Validation trial / performance of ‘Ghar sodhon’ in various farmers field under RSRS, REC and DOS during 2014-15.

Unit / farmers	Season	Breed	Type	Farm/ farmers	DFLs	Disease %	ERR %	Kg / 100 dfls	Gain (kg)
RSRS, Kalimp'g	-	SK6	P	1	-	4.0	96.0	63.98	1.48
			C	1	-	5.0	95.0	62.50	
REC SU M P Raj	Shravani	N x M12W	P	1	25	4.0	96.0	36.92	2.77
			C	1	25	5.8	94.2	34.15	
REC SU M P Raj	Aswina	M.Con.1 x B.Con.4	P	5	125	8.5	91.5	50.80	3.40
			C	5	125	13.2	86.8	47.40	
REC Kamnagar	Aswina	N x M12w	P	10	500	8.4	91.6	32.06	4.21
			C	10	500	16.7	83.3	27.85	
REC Kamnagar	Aghrayani	N x (SK6xSK7)	P	10	500	8.2	91.8	51.45	4.40
			C	10	500	12.5	87.5	47.05	
REC MP Raj	Aghranani	N x (SK6xSK7)	P	5	125	8.2	91.8	50.60	5.00
			C	5	125	16.7	83.3	45.60	
DOS Nalhati	Falguni	N x Bi	P	10	1000	6.5	93.5	40.20	5.08
			C	10	1000	12.5	87.5	35.12	
REC SU Rajmahal	Falguni,15	M6DPC x (SK6xSK7)	P	10	1000	2.0	98.0	48.68	4.43
			C	10	1000	3.5	96.5	44.25	
REC Mothabari	Falguni,15	N x Bi	P	10	500	8.4	91.6	44.98	4.37
			C	10	500	16.4	83.6	40.61	
<b>Grand total</b>			<b>P</b>	<b>62</b>	<b>3775</b>	<b>6.5</b>	<b>93.5</b>	<b>46.63</b>	<b>3.90</b>
(P: with Ghar sodhon; C: Control)			<b>C</b>	<b>62</b>	<b>3775</b>	<b>11.4</b>	<b>88.6</b>	<b>42.73</b>	

Powder formulation of ‘Ghar sodhon’ was found most effective, broad spectrum, cost - effective and user friendly room disinfectant for the purpose of disinfection of rearing houses, grainages, rearing appliances and equipments with yield gain: 4 - 5 kg/ 100 dfls. After one time application, it ensures to destroy initial germ load in the rearing house / appliances thereby keep the rearing rooms / appliances free from pathogens at the outset of silkworm rearing. **Benefit Cost Ratio: 3.42: 1** (over 5% Bleaching powder - room disinfectant).



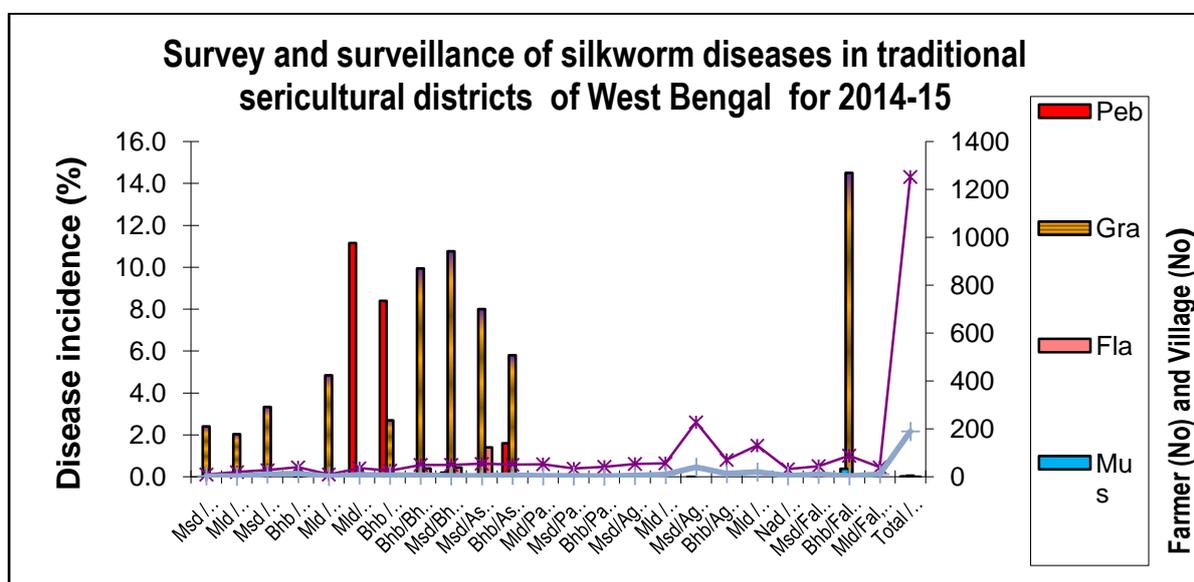
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### 10.B.5.3.BAR (RP)005: Survey and surveillance of silkworm diseases in traditional sericultural districts of West Bengal. (Apr, 14 to Mar, 15).

S. Chakrabarty, A. K. Dutta (REC, Mothabari), D. Pandit (REC, M P Raj), (Mrs).Tapati Dutta (Biswas), (REC, Kamnagar) and In Charge, (REC, Rajmahal).

**Objectives:** Suggest effective remedial measures ‘on spot’ to the farmers’ to control the disease and forewarn the farmers’ for ensuing commercial crop in West Bengal. To prepare database on the incidence of various diseases of silkworm, *B.mori* during commercial crops in the traditional sericultural districts of West Bengal.

Crop wise survey of silkworm diseases was conducted at the 1253 farmers’ houses in 189 villages in traditional sericultural districts viz., Murshidabad, Malda and Birbhum in West Bengal. Pool data analysis indicated that 7.1 % diseases were recorded in three traditional districts of West Bengal (Pebrine- 0.9%, Grasserie 2.8%, Flacherie 0.1%, Muscardine 2% and Gattine 1.3%). However, critical analysis revealed that the incidence of ‘Pebrine’ was found 0.2 - 11.2 % during Shrivani (June-July), 0.2 % during Bhaduri (Aug.-Sept.) and 1.6 % in Aswina (Aug. – Sept.) crop in three districts of West Bengal. **In Murshidabad**, crop loss reported 10.7 % and 8% due to Grasserie during ‘Bhaduri’ and ‘Aswina’ crop, 14 and 5.38% due to ‘Muscardine’ during Falguni crop,14. **In Birbhum**, high incidence of Muscardine (33.3%) and Grasserie (14.50 %) was recorded during Falguni crop, 15. High incidence of Pebrine ( 8.4 %) was recorded during Shrivani crop, 14. **In Malda**, high incidence of pebrine (11.2%) and Gattine (11.2%) was observed during Shrivani, 14 crop, high incidence of Muscardine (7.2 %) was recorded during Falguni,14 crop. **In Nadia**, during Agrahayani crop, 14, no disease incidence recorded.



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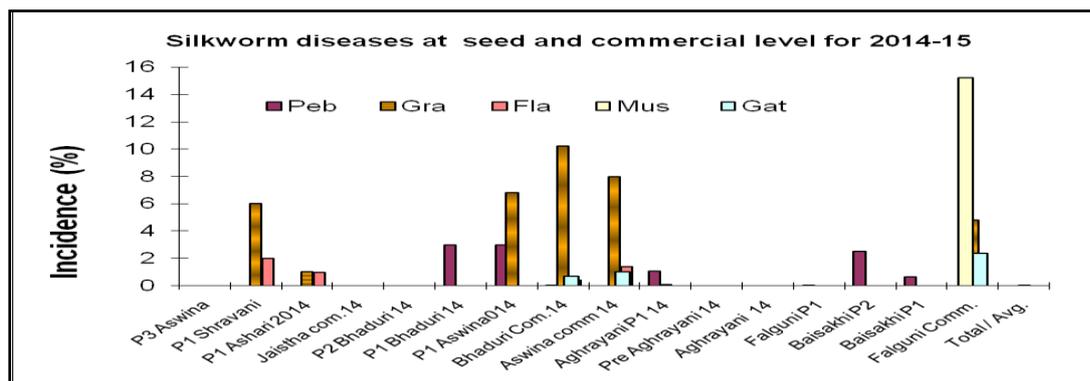
**10.B.4.BAI(RP)006:Silkworm Disease Monitoring of Seed and Commercial Crop (SDMSCC) rearing of West Bengal.** (Apr.,14 to Mar., 15) - A collaborative programme with ZSSO, Malda and DoT (Seri), West Bengal.

S. Chakrabarty, A. K. Dutta (REC, Mothabari); Tapati Dutta (Biswas), (REC, Kamnagar); U. K. Bandyopadhyay (upto June,14), S. Chatterjee, (RSRS, Kalimpong); Incharge (BSF, Karnasubarna); K.K.Sinha (SSPC, Kalitha); P. K. Biswas (BSF, Banguria); S.K.Sen(ZSSO, Malda); L.M.Saha (SSPC, Berhampore); M. K. Ghosh (SSPC, D. B. Pur); R. Bhutia (BSF, Ambarifalakata); S. Ghosh (SSPC, Raiganj); S. K. Majumdar (BSF, Dhubulia); Z. Hossain, A. K. Verma, and 10 Extension Officers, DoT(Seri), West Bengal.

**Co-ordinators:** Shri Bijoy Mukherjee, Addl. Director, DOT(Seri),Govt. of West Bengal and Dr.K.Mandal, Scientist-D, ZSSO, Malda.

**Objectives:** To identify the disease responsible for crop loss at DOT(S), NSSO and farmers' field during seed and commercial crops and to suggest effective remedial measures 'on spots' to the farmers'/farms' to prevent / management the disease for ensuing crop. Strict vigils of disease 'out break' reported at seed and commercial crops and suggest effective remedial measures 'on spot' to the farmers'/ farms' to prevent / management of the disease for ensuing crop.

A total of 1993 samples (885 for seed and 1108 for commercial) were examined from farmers of 234 villages and DoS farms during parental (P3/P2/P1) and commercial rearing in 10 (Ten) sericulture districts, Murshidabad, Birbhum, Nadia, Malda, Uttar Dinajpur, Dakshin Dinajpur, Jalpaiguri, Darjeeling (Plain and Hill), Coochbehar and Midnapore of West Bengal. Critical analysis revealed that incidence of 'Pebrine' was found to the tune of 0.03-3% during Bhaduri (P2, P1), Aswina (P1), Agrahayani (P1), Falguni (P1) and Baisakhi (P2, P1) seed crops. Grasserie (10.2%) and Muscardine (15.2%) diseases also prevalent during Bhaduri and Falguni commercial crop respectively. Grasserie (4.8%) and Gattine (2.4%) diseases were also recorded during Falguni commercial crop.



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### **10.B.5.BAR (P) 024: Identification of pathogens causing Gattine like disease in the silkworm *Bombyx mori* L. (Jul., 13 to Dec., 14).**

Z. Hossain .

**Objectives:** Identification of pathogens causing Gattine like disease in silkworm *B. mori*.

#### **Methodology:**

**1. Isolation and purification of bacterial and viral pathogens from Gattine like diseased silkworms:** Isolation of bacteria from gut lumen of diseased silkworm and maintenance of axenic cultures by sub-culturing in suitable culture media. Isolation and purification of viral pathogen using PEG 6000/Ammonium Sulphate as the viral precipitant.

#### **2. Identification of the bacterial and viral pathogen from silkworm, *B. mori* L.**

Survey on silkworm diseases in West Bengal indicated the prevalence of Grasserie, Flacherie, Muscardine, Pebrine and Gattine resulting average crop loss to the tune of 15-30% depending on season of which, Gattine contributes 10-30% of crop loss during dry seasons (May-June). Attempt using two protocols were made to isolate and purify the virus from the V<sup>th</sup> stage diseased larval samples of silkworms collected from farmers' field and also from the rearings conducted in the institute as well. The modified protocol of Himeno *et al.*, 1979 using ammonium sulphate as the virus precipitant was attempted. After partial purification of the diseased samples in this Institute, they were subjected to Sucrose Density Gradient Ultra Centrifugation for final purification at Indian Institute of Chemical Biology, Jadavpur, Kolkata. A second protocol of Sivaprasad *et al.*, 2003 using PEG 6000 as the virus precipitant was also employed for isolation of the virus. The so called 'Gattine like' disease is caused by bacteria only. Presence of any Non-occluded virus could not be ascertained with the protocols used. If at all any NOV is there, a separate protocol may be developed to isolate and purify the virus. The samples revealed presence of bacterial pathogen which was identified as *Staphylococcus vitulinus*. However, no virus was detected in the samples

## **10.B.2. REGIONAL SERICULTURAL RESEARCH STATION**

### **10.B.2.1.RSRS, KALIMPONG**

**10.B.2.1.1.BKPG(P)028:Elimination of diapause expression from eggs in improved multivoltine silkworm breeds.** (Co-ordinated programme with CSR&TI Berhampore) (Apr., 14 to Jan.,15).

U. K. Bandyopadhyay, (up to June, 14) and S. Chatterjee (from July, 14).

**Objectives:** To eliminate the diapausing expression eggs from improved multivoltine silkworm breeds for preparation of multi x bi or multi x multi hybrid dfls.



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Cellular rearing of 5 dfls each of M.Con.1, M.Con.4 and M6DP (C) multivoltine silkworm breeds were done during spring and summer seasons and grainage was conducted for expression of diapause in the produced layings.

During spring crop, a total of 514 dfls of M.Con.1, 421 dfls of M.Con.4 and 524 dfls of M6DP (C) and during summer crop, a total of 612 dfls of M.Con.1, 473 dfls of M.Con.4 and 653 dfls of M6DP (C) were produced and examined. No layings with expression of diapause were found in any of the above breeds. Rearing and Grainage performance of the breeds is presented in Table-66.

**Table 66. Rearing and Grainage performance**

Crop	Breeds	Fecundity (No)	Hatching (%)	SCW (g)	SSW (g)	Shell (%)	Cocoon Yield		Avg. yield/ 100 dfls (kg.)	Dfls prod.
							No	Wt (g)		
Spring	M. Con 1	458	90.90	1.35	0.208	15.41	289	426	42.58	514
	M. Con 4	425	95.25	1.470	0.215	14.65	265	378	37.80	421
	M6DPC	513	94.37	1.287	0.154	11.97	321	388	38.75	524
Summer	M. Con 1	630	96.65	1.366	0.162	11.88	361	476	47.63	612
	M. Con 4	657	97.73	1.619	0.235	14.53	251	381	38.13	473
	M6DPC	504	96.03	1.383	0.160	11.55	370	515	51.46	653

Layings produced in the successive two generations were free from expression of diapause in the layings.

### **10.B.2.1.2. B-KPG(RP)010:Survey & Surveillance of Mulberry and Silkworm Diseases & Pests in Kalimpong Hill (Oct., 13 to Sept., 14).**

S. Chatterjee , U. K. Bandyopadhyay (up to June, 2014), M.D. Maji.

**Objectives:** To identify pests and diseases responsible for loss of mulberry foliage at farmers level during seed crop seasons and to suggest effective remedial measures to protect the mulberry leaves for the ensuing crop. Detection of mulberry pests and diseases during different crop seasons with infection / infestation severity. To identify the disease responsible for crop loss at farm and farmers level during seed crop seasons and to suggest effective remedial measures on spots to prevent the disease for ensuing crop.

**Mulberry diseases & pests:** Data was recorded from nine farmers' fields from three villages. 05 selected plants selected for counting mulberry diseases and pests.

**Silkworm diseases:** Collection of worms from farmers rearing houses and conducting microscopic examination of larvae / pupae in three P1 bivoltine seed crops of Kalimpong area of Darjeeling district, West Bengal.



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• **Seed Crop Schedule :**

- i) Spring crop : 22<sup>nd</sup> – 24<sup>th</sup> April (Brushing date)
- ii) Summer Crop : 22<sup>nd</sup> – 24<sup>th</sup> June (Brushing date)
- iii) Autumn Crop : 22<sup>nd</sup> – 24<sup>th</sup> August (Brushing date)

**Mulberry diseases:**

Mulberry disease survey at nine farmers' field covering in three villages in Kalimpong hill located at altitude 1200- 1400 mts above msl. During spring and summer crop , no disease occurrence reported. Low severity powdery mildew (3.7-5.1 PDI), brown leaf rust (1.14-5.47 PDI) and sporadic incidence of yellow leaf rust (0.14-1.14 PDI) was reported during Autumn crop (Table 67).

**Table 67. Mulberry disease incidence and severity in Kalimpong hills.**

Crop	Village	Disease incidence and Severity						Recommendation
		Powdery Mildew		Brown leaf rust		Yellow leaf rust		
		PI	PDI	PI	PDI	PI	PDI	
Spring	Bhalukhop	No diseases were observed						-
	Mahakaldara							
	Saureni							
Summer	Bhalukhop	No diseases were observed						-
	Mahakaldara							
	Saureni							
Autumn	Bhalukhop	13.38	5.08	13.71	5.47	0.00	0.00	Spray of 0.1% Carbendazime
	Mahakaldara	14.00	5.43	3.27	1.14	0.71	0.14	
	Saureni	10.93	3.67	4.03	1.30	3.17	1.14	
	Mean	<b>12.77</b>	<b>4.73</b>	<b>7.00</b>	<b>2.64</b>	<b>1.29</b>	<b>0.43</b>	

**B: Mulberry Insect pests:** Major insect pests such as root mealy were found in all the three crops, while leaf webber, was found during both summer and autumn crops. (Table 68).

**Table 68. Mulberry Insect Pests recorded during Spring, Summer & Autumn crop, 2014.**

Crops →	Spring 2014	Summer 2014	Autumn 2014			
Villages	Insect Pests					
	Root Mealy bug/plant	Thrips/leaf	RMB/plant	Leaf webber	Root Mealy	Leaf webber
Mahakaldara		0.62				
Bhalukhop		0.31				
Saureni	1.27	0.49	2.97	1.73	1.97	2.93

N.B.: Data in the table represents insect pest number (avg.) per plant where as in case of Thrips, pest number (avg.) per leaf.

**C: Silkworm diseases:** During Spring, Summer and Autumn crop 2014 only Grasserie disease ( 0 – 11), (0 – 5 %) was observed respectively (Table 69).



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**Table 69. Silkworm Disease recorded during Spring, Summer & Autumn crop.**

Sl. No	Village	Grasserie Incidence (Avg.%)		
		Spring crop, 2014 (April-May)	Summer crop, 2014 (June-July)	Autumn crop, 2014 (Aug.-Sept.)
1.	Bhalukhop	4.11 (3.33-5.33)	1.89 (1.33-2.67)	2.47 (1.56-3.26)
2.	Saureni	6.00 (4.33-7.33)	2.67 (2.33-3.00)	2.64 (2.11-3.10)
3.	Mahakaldara	5.56 (4.67-6.33)	2.48 (2.38-2.64)	2.53 (1.95-3.25)

**10.B.2.1.3.B-KPG(P)006: Muga Seed Multiplication Programme.** [Coordinated programme with MSSO, Guwahati]. ( Nov., 09 to Oct., 14).

M. D. Maji

**Objectives:** Establishment of muga food plantation at P-4 farm for muga seed crop rearing. Maintenance of 6 acres Som and Soalu plantation at Hill Nursery. Rearing of muga silkworm and production of muga dfls during Aheura Pre seed (June-July) and Bhodia seed (Aug.-Sept.) crop.

**A. Establishment and Maintenance of muga host plantation:** Plantation maintained as per schedule.

**B. Muga silkworm rearing performance:** Muga silkworm rearing was started from the year 2010 during seed crop. Rearing performance of Muga silkworm is presented in Table 71. During the programme period, 2460 dfls were brushed from which 33,521 cocoons were harvested with ERR 14.2%. On rearing parameters, 5<sup>th</sup> stage mature larval weight was recorded 14.4 g. Cocoon assessment revealed that single cocoon wt. and shell wt. was 5.36 g and 0.45g respectively and shell ratio was 8.3%.

**Table 70. Rearing performance of muga silkworm at Kalimpong hills.**

Year	Crop	Dfls reared (g)	No. of eggs/g	Hatching (%)	Larval wt. (g)	Larval duration (days)	Cocoon harvested	ERR (%)	Cocoon weight (g)	Shell weight (g)	Shell (%)
2010	June-July	540	-	80	-	52	6216	11.51	5.55	0.51	9.19
2011	June-July	400	132	75	12.05	30	11816	29.84	5.00	0.38	7.60
2012	Aug. - Sept.	400	134	80	12.97	28	12310	28.71	5.87	0.57	9.71
2013	July-Aug	400	134	74	Rearing could not continued due to continuous bandh						
2014	June-July	300	137	62	15.26	27	2125	8.14	5.27	0.37	7.06
	Aug.-Sept.	400	135	60	15.54	30	975	3.95	5.09	0.43	8.45
		20	145	70	16.21	30	79	3.24	5.35	0.43	8.04
		2460	136.2	71.6	14.41	29	33521	14.23	5.36	0.45	8.34

**C. Grainage performance:** Grainage performance of Pre seed (June-July) and Seed (Aug.-Sept.) crop is presented in Table 71.



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**Table 71. Grainage performance of muga silkworm at Kalimpong hills**

Year	Crop	Cocoon processed (nos.)	Disease		Dfls produced Wt. (g)	Cocoon: dfls ratio
			Peb	Gra/Fla		
2010	August	5180	0	32	2255	2.29:1
2011	August	11280	116	28	1829	6.17:1
2012	October	11510	0	0	1992	5.78:1
2013	Grainage could not conducted due to continuous bandh					
2014	August	1875	0	0	620	3.02:1
	October	1002	0	0	70	14.31:1
<b>Total</b>		<b>30847</b>	<b>116</b>	<b>60</b>	<b>6766</b>	<b>4.56 :1</b>

### D. Dfls supply

A total of 6,766 dfls were produced and 6746 dfls were supplied to MSSO, Guwahati, DoT (Seri), W. B, DoS, Chattisgarh for rearing. A detail of dfls supply is presented in Table 72.

**Table 72. Details of supply of muga dfls**

Year	Crop	Dfls produced wt. (g)	To whom supplied
2010	August	2255	<ul style="list-style-type: none"> <li>1715 dfls supplied to Dy. Director, Cooch Behar, West Bengal; 150 dfls supplied to Asst. Director, North Dinajpur, West Bengal; 250 dfls supplied to DoS ,Sikkim for Mamring Farm; 140 dfls supplied DoS ,Sikkim for Rorathung Farm</li> </ul>
2011	August	1829	<ul style="list-style-type: none"> <li>1409 dfls supplied to MSSO, Guwahati; 410 dfls supplied to the Aast. Dir. Seri, Panchmari, Madhya Pradesh.</li> </ul>
2012	October	1991	<ul style="list-style-type: none"> <li>1991 dfls supplied to the Scientist-D, MSSO, Guwahati.</li> </ul>
2013	Dfls could not be produced due to continuous bandh.		
2014	August	620	<ul style="list-style-type: none"> <li>400 dfls to DoT (Seri), Kalimpong, West Bengal; 200 dls to MSSO, Guwahati.</li> </ul>
	October	70	<ul style="list-style-type: none"> <li>70 dfls to DoT (Seri), Jalpaiguri, West Bengal.</li> </ul>
<b>Total</b>		<b>6765</b>	

The rearing and grainage performance clearly indicates that muga seed crop can be successfully conducted at sub-tropical hills of Kalimpong under changed climatic scenario to save the glorious muga industry. The performance can be enhanced by development of region specific technology suitable for the region with appropriate infrastructure facilities.



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### **10.B.1.6.B-KPG(PS)007: An integrated approach to study the effect of Potassium Humate on soil health, yield and quality of mulberry leaves to promote sustainable sericulture in Sub-Himalayan region of Eastern and North-Eastern India (Apr., 14 to Mar., 15).**

R.L. Ram, R. Bhutia (up to June 2014) and C. Maji (from July 2014).

**Objective:** To study the effect of potassium humate on soil health, yield and quality of mulberry leaves. To know the effect of potassium humate on silkworms and quality cocoon fed on treated mulberry leaves.

#### **Treatment combination**

**T<sub>1</sub>:** NPK@150:50:50 kg ha<sup>-1</sup>+FYM @10 mt ha<sup>-1</sup>; **T<sub>2</sub>:** NPK@150:50:50 kg ha<sup>-1</sup>+FYM @10 mt ha<sup>-1</sup> + Potassium humate@25 kg ha<sup>-1</sup>; **T<sub>3</sub>:** NPK@150:50:50 kg ha<sup>-1</sup>+FYM @7.5 mt ha<sup>-1</sup> + Potassium humate@25 kg ha<sup>-1</sup>; **T<sub>4</sub>:** NPK@150:50:50 kg ha<sup>-1</sup>+FYM @5 mt ha<sup>-1</sup> + Potassium humate@25 kg ha<sup>-1</sup>; **T<sub>5</sub>:** No NPK + FYM @20 mt ha<sup>-1</sup> + Potassium humate@25 kg ha<sup>-1</sup> (Totally organic); **T<sub>6</sub>:** No NPK + FYM @10 mt ha<sup>-1</sup> + Potassium humate@25 kg ha<sup>-1</sup> (Totally organic).

Mulberry leaf yield and biochemical analysis revealed that maximum 6.88± (0.71) mt ha<sup>-1</sup> leaf yield was recorded in the autumn crop, 2014 after the application of NPK@150:50:50 kg ha<sup>-1</sup>+FYM @10 mt ha<sup>-1</sup> + Potassium humate@25 kg ha<sup>-1</sup>. (T<sub>2</sub>) followed by maximum 6.75± (0.54) mt ha<sup>-1</sup> after the application of NPK@150:50:50 kg ha<sup>-1</sup>+FYM @7.5 mt ha<sup>-1</sup> + Potassium humate@25 kg ha<sup>-1</sup> (T<sub>3</sub>) against the control (recommended) 5.76± (0.57) mt ha<sup>-1</sup>. In the case of organic mulberry farming, maximum 6.42± (0.53) mt ha<sup>-1</sup> leaf yield was recorded after the application of FYM @20 mt ha<sup>-1</sup> + Potassium humate@25 kg ha<sup>-1</sup> (T<sub>5</sub>). Similarly, Total Chlorophyll; Total Soluble Protein; Total Soluble Sugar; Total Nitrogen and Crude Protein was also higher by the application of Potassium humate@25 kg ha<sup>-1</sup> (T<sub>2</sub>) and T<sub>5</sub>) alongwith recommended doses of both organic and inorganic mulberry farming. Details of the effect of potassium humate on yield and quality of mulberry leaves at RSRS farm level are given below in Table 73.

**Table 73. Effect of potassium humate on yield and quality of mulberry leaves at RSRS farm level**

Treatment	Yield (mt ha <sup>-1</sup> )	Gain (%)	Moisture (%)	Fresh weight (mg g <sup>-1</sup> )			Dry Weight (%)	
				TCH	TSP	TSS	TN	CP
T <sub>1</sub>	5.76 ±0.57	0.00	75.85 ±0.41	1.29 ±0.01	19.86 ±0.24	30.09 ±0.49	3.11 ±0.13	19.43 ±0.84
T <sub>2</sub>	6.88 ±0.71	19.44	75.53 ±0.43	1.77 ±0.04	26.00 ±0.25	36.23 ±0.25	3.58 ±0.15	22.40 ±0.93
T <sub>3</sub>	6.75 ±0.54	17.18	76.65 ±0.33	1.69 ±0.02	25.54 ±0.19	35.56 ±0.17	3.42 ±0.12	21.39 ±0.75
T <sub>4</sub>	5.42 ±0.25	-5.90	75.44 ±0.23	1.34 ±0.04	24.91 ±0.11	34.27 ±0.20	3.09 ±0.09	19.32 ±0.59
T <sub>5</sub>	6.42 ±0.53	11.46	76.78 ±0.16	1.61 ±0.02	25.82 ±0.30	34.34 ±0.36	3.33 ±0.13	20.8 ±0.79
T <sub>6</sub>	5.34 ±0.23	-7.29	75.32 ±0.37	1.33 ±0.03	19.72 ±0.15	29.40 ±0.19	2.85 ±0.15	17.8 ±0.92

± = Standard Error; TCH = Total Chlorophyll; TSP = Total Soluble Protein; TSS = Total Soluble Sugar; TN = Total Nitrogen; CP = Crude Protein



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### 10.C. RSRs, KORAPUT (ODISHA)

#### 10.C.1. B-KPT(RP) 013: Survey & Surveillance for Mulberry & Silkworm diseases and their control. (Ap., 14 to Mar., 15)

S. K. Misro and N. R. Rao

Incidence of three major mulberry foliar diseases viz. *Pseudocercospora* leaf spot (PLS), Brown Leaf Rust (BLR) and Powdery Mildew (PMLD) prevailed in Koraput district were recorded at monthly intervals at 10 farmers' fields and presented in Table 74. The recorded Percentage Disease Index (PDI) of the three foliar diseases revealed that, the disease infestation in all three cases is below Economic Threshold level (ETL). Silkworm disease incidence data were recorded at farmer's level during three major rearing seasons and presented in Table 75. Farmers were advised to take necessary control measures to minimize the disease incidence.

**Table 74. Mulberry foliar disease incidence data at farmers' field**

Month	Brown Leaf Rust (BLR)		Pseudocercospora Leaf Spot (PLS)		Powdery Mildew (PMLD)	
	PI	PDI	PI	PDI	PI	PDI
April 14	6.18	2.78	--	--	--	--
May, 14	9.23	3.52	--	--	--	--
June, 14	13.56	2.49	--	--	--	--
July, 14	Due to bottom pruning no foliar disease incidence was found					
Aug., 14	--	--	--	--	--	--
Sept., 14	7.31	2.72	6.56	2.15	--	--
Oct., 14	9.11	2.73	8.11	2.16	--	--
Nov., 14	11.61	3.33	8.33	2.16	12.35	3.53
Dec., 14	10.40	2.97	9.58	2.74	14.95	4.17
Jan., 15	Due to middle pruning, no disease incidence was found					
Feb., 15	--	--	--	--	--	--
Mar., 15	6.67	1.73	--	--	--	--

**Table 75. Seasonal incidence of Silkworm diseases at farmers' level**

Season	Dfls	Farmers	Gra.%	Fla.%	Musc.%	Gatt.%	Peb.%
Aug.-Sept., 14	M x Bi	10	12.87	10.92	2.32	--	--
Oct.-Nov., 14	Bi x Bi	10	3.35	--	3.66	--	--
Feb.-Mar., 15	Bi x Bi	10	1.87	--	--	--	--

#### 2.A.2.B-KPT(RP)014: Silkworm Disease Monitoring of Seed and Commercial Crop Silkworm Rearing of Non-Traditional districts of Odisha. (Ap., 14 to Mar., 15).

N. R. Rao.

**Objective:** Suggests effective remedial measures 'on spot' to the farmers' to control the disease and forewarn the farmers' for ensuing commercial crop in Odisha. To prepare database on the incidence of various diseases of silkworm, *Bombyx mori* during commercial crops in the traditional sericultural districts of Odisha.

No incidence of silkworm diseases was noticed.



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### 10.D. RSRs, JORHAT (ASSAM)

#### 10.D.1.MOE 3459: Yield gap in mulberry sericulture – A study in North-Eastern region of India. (Oct., 11 to Apr., 14).

M. Pamehgam

**Mulberry** : Yield gap between research station potential yield (A) and potential farm yield (demonstration level) was significantly high in Assam (28.5%) followed by Manipur (20.7%) and Tripura (19.23%), least was observed in Nagaland (7.8%) with respect to mulberry leaf yield, while the gap between potential demonstration plot yield (B) and farmers farm yield (C) was significantly higher in Assam (45.4 %) followed by Manipur (34.3%) and least in Mizoram (18.9%).

**Silkworm** : Yield gap between research station potential yield (A) and potential farm yield (demonstration level) was significantly high in Mizoram (13.6%) followed by Nagaland (11.2%) and least was observed in Manipur (6.3%) with respect to bivoltine cocoon production, while the gap between potential demonstration plot yield (B) and farmers farm yield (C) was significantly high in Mizoram (27.5%) followed by Nagaland (27.1%) and least in Manipur (16.2%).

The respondents adopted fully or partially many of the mulberry cultivation and silkworm rearing practices, except some of the crucial practices such as use of chemical fertilizer, plant protection measures, partial pruning practices due to lack of technological knowledge and infrastructure. In silkworm rearing lack of knowledge on chawki rearing package (100%) was maximum, partial adoption of black boxing technology are high among the farmers. The findings will be provided to DoS, Assam. State level workshop and Extension communication programmes will be organized to make aware of the findings in order to facilitate the field functionaries and stakeholders for minimizing the gaps and improve crop yield in the region.

#### 10.D.2.B-JRH (PS) 005: Identification of productive Multi x Bi hybrids for plains of NE states of India through development of improved multivoltine breeds of silkworm, *Bombyx mori* L utilizing local indigenous strains. (Apr., 13 to May, 14).

T.K. Biswas

Parental study revealed extreme robustness of indigenous breed *C.nichi* of exotic origin under the condition showing highest survival. Among the indigenous breeds, local breed Leimarel showed the highest yield and cocoon characters. In F1 PM x Barpat showed the higher genetic divergence apart from geographical and phenotypical distances. In double hybrids, (N x CN) x (Lei x PM) exhibited best performances in both in terms of survival and yield.



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

#### 11.1. All India Co-ordinated Experimental Trial on Mulberry (Phase-III) (Apr., 11 to Dec., 16)

**Zonal Coordinator:** S. Nirmal Kumar, Director, CSR&TI, Berhampore  
M.K. Ghosh, S.N. Gogoi, G.S. Singh, R. Sahu, M.D. Maji and L. S. Singh

**Objective:** To identify and authorize suitable mulberry variety for commercial use in different agro-climatic mulberry cultivation zones of India.

The experiment was conducted in RBD with 6 replications and plants spacing was 90 cm × 90 cm, Total number of plants/ experimental plot was 81.

Data recorded on leaf yield in different test centres showed that in seven test centers MV1 (C203380 was performed best in both irrigated and rainfed condition. However, at RSRS, Kalimpong (hills of West Bengal) Tr-23 registered as the top yielder. (Table 76)

**Table 76. Annual leaf yield (kg/ha/year) of the test entries of 1<sup>st</sup> year.**

Test Center	Leaf yield (kg/ha/year)					CD at 5%
	MV-1 C-2038	MV-2 G-4	MV-3 Suvarna-2	MV-4 Vishala	MV-5 S-1635	
<b>Irrigated (5 crops)</b>						
CSR&TI, Berhampore	43654	38977	36814	38517	39420	<b>1942</b>
<b>Rainfed (3 crops)</b>						
RSRS, Jorhat, Assam	18624	15773	14147	17309	17046	<b>990</b>
DoT(Seri), Ambari Falakata, West Bengal	16919	13433	15615	17556	17275	<b>718</b>
REC(SU), Bhandra, Ranchi, Jharkhand	18831	16384	16860	16293	15612	<b>1007</b>
RSRS, Koraput, Odisha	18331	13633	17116	14212	12551	<b>1290</b>
REC, Imphal, Manipur	17692	14874	13114	14063	13640	1384
DoT(Seri), Boswa, Birbhum West Bengal	19205	15924	15375	15402	15353	<b>1094</b>

Test Centre	Leaf yield (kg/ha/year)						CD at 5%
	MV-1 C-2038	MV-2 G-4	MV-3 Suvarna	MV-4 Tr-23	MV-5 Vishala	MV-6 S-146	
<b>Rainfed (3 crops)</b>							
RSRS, Kalimpong	8270	7519	8917	10935	8793	9245	<b>1461</b>

A. **Kalimpong test centre:** Leaf yield was highest in Tr-23 (4075 kg) and S-146 (3380 kg/ha/crop) during spring and also summer and in autumn, Suvarna -2 was the best performer (Table 77).



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**Table 77. Leaf yield of the Test varieties at Kalimpong test centre**

Varieties	Leaf yield (kg/ha/season)			Total leaf yield(kg/ha/yr)
	Spring	Summer	Autumn	
C-2038	3058.07	2710.56	2502.06	8270.69
FYT/99-G4	3160.49	2267.95	2092.36	7520.8
Suvarna-2	3314.13	2677.64	3219.02	9210.79
Tr-23	4074.99	3379.06	3189.76	10643.81
Vishala	3277.55	2663.01	2853.22	8793.78
S-146	3379.97	2867.86	2999.54	9247.37
CD (0.05)	525.74	478.89	524.82	

B. **Ambari Falakata test centre:** Pooled data of leaf yield was revealed highest in C 2038 (19056.5 kg/ha/yr) followed by 1635 (17014.4 kg/ha/yr) (Table 78)

**Table 78. Leaf yield of test centre at Ambari Falakata Sericultural Project Farm**

Varieties	Leaf yield (kg/ha/season)			Total leaf yield (kg/ha/yr)
	Spring	Summer	Autumn	
C-2038	3035.98	8572.02	7448.56	19056.56
FYT/99-G4	2283.96	6748.97	4423.87	13456.8
Suvarna-2	2551.44	8086.42	5065.84	15703.7
Vishala	3197.53	8668.72	4094.65	15960.9
S-1635	2888.89	8837.45	5288.07	17014.41
CD (0.05)	173.25	1366.26	904.7	-

**Jorhat test centre:** Data recorded on sprouting, survival %, growth parameters, moisture content, moisture retention capacity, leaf shoot ratio and leaf yield showed highest in C-2038 (Table 79).

**Table 79. Morphological characters and leaf yield of mulberry accessions in agro climatic conditions of Assam (June, 2014 and Sept., 2014 crop).**

Variety	Sprouting (%)	Total shoot length /plant (cm)	Leave /meter	Leaf / shoot ratio (%)	Moisture content (%)	MRC (%)	Leaf yield/ Ha /crop /kg
C-2038	10.17	596.70	21.83	57	75.61	70.14	6891
	<b>11.83</b>	<b>498.50</b>	<b>22.33</b>	<b>0.56</b>	<b>75.06</b>	<b>70.11</b>	<b>6551</b>
FYT/99-G4	14.33	477.00	22.00	54	74.36	66.64	5850
	<b>13.67</b>	<b>476.67</b>	<b>20.50</b>	<b>0.53</b>	<b>78.49</b>	<b>71.94</b>	<b>5556</b>
Suvarna-2	16.83	465.83	21.95	56	75.30	65.38	5266
	<b>14.00</b>	<b>479.17</b>	<b>22.67</b>	<b>0.57</b>	<b>78.52</b>	<b>71.13</b>	<b>5480</b>
Vishala	11.83	524.37	18.73	56	74.58	67.49	6345
	<b>12.50</b>	<b>558.83</b>	<b>18.50</b>	<b>0.56</b>	<b>77.63</b>	<b>70.37</b>	<b>6286</b>
S1635	9.50	524.23	19.10	55	73.40	64.91	6059
	<b>10.83</b>	<b>490.00</b>	<b>20.67</b>	<b>0.56</b>	<b>76.80</b>	<b>68.13</b>	<b>6127</b>
Mean	12.53	517.63	20.72	56	74.65	66.89	6082
	<b>12.57</b>	<b>500.63</b>	<b>20.93</b>	<b>0.55</b>	<b>77.30</b>	<b>70.34</b>	<b>6000</b>
CD at 5%	4.85	32.70	1.95	0.01	NS	NS	351.80
	<b>0.90</b>	<b>31.65</b>	<b>1.76</b>	<b>0.01</b>	NS	NS	<b>292.75</b>

Note: Data in bold is Sept., 2014 crop



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

The Central Silk Board has envisaged an ambitious plan to produce 5000 mt import substitute BV silk through organization of clusters across the country in co-ordination with DoT (Seri.)/ DOS of the respective states in a mission mode approach during XII plan period. CSR&TI, Berhampore functioning as Nodal Centre for Eastern & North Eastern India, where, 15 clusters at West Bengal (4), Odisha (2), Bihar (1), Manipur (2), Assam (3), Mizoram (1), Nagaland (1), and Tripura (1) were being organised with the active support of the respective DOSs.

Based on the diagnostic and feasibility study, clusters identified and Cluster Promotion Committees (CPCs) were constituted for effective implementation. Zonal Bivoltine Review committee has been constituted under the chairmanship of the Director, CSR&TI and the Director of Sericulture, DoS/ DoT as the members along with in-charges of ROs, RSRs, and CDFs.

For effective monitoring of the clusters, JCPCs meeting were conducted every month to review the progress and chalk out the future plan of action. Zonal Programme Review Committee meetings were held quarterly to review the progress of the clusters.

State	Cluster	Cluster Development Facilitator	
		CSB Representative	DOS Representative
West Bengal	Malda	Shri A. K. Datta, Sci-C, REC, Mothabari, Malda	Shri S. K. Das, Dy. Director DoT(Seri), Malda.
	Murshidabad	Dr. T Dutta (Biswas), Sci-D, REC, Kamnagar, Murshidabad	Dr. M. Banerjee, Dy. Director, DoT(Seri), Murshidabad.
	Birbhum	Dr. M. Patnaik, Sci-D, REC (SU), Rampurhat, Birbhum	Sri. S. N. Koley, Dy. Director, DoT(Seri), Suri, Birbhum
	Nadia	Shri G. C. Das, Sci-C, CSR&TI, Berhampore	Sri A. K. Pani, Asst. Director, DoT(Seri), Krishnagar, Nadia
Odisha	Ghatgaon	Shri Satyabrata Dey, Sci-C, BSM&TC, Keonjhar	Smt Lucia Lakra, Dy. Director, DoS, Keonjhar
	Kashipur	Shri Sunil Kr. Mishra, Sci-C, RSRs, Koraput	Shri Bijaya Kumar Mishra, Asst. Director, DoS, Koraput
Manipur	Churachandpur	Dr. L. Somen Singh, Sci-D, REC, Imphal	Shri N. Vialkhanthang, Dy. Director, DoS, Manipur
	Ukhrul	Dr. L. Somen Singh, Sci-D, REC, Imphal	Shri C. M. Paul, Asst. Director, DoS, Manipur
Mizoram	Aizawl	Shri B. N. Choudhury, Sci-D, REC, Aizawl	Shri Lalremsiama, Asst. Director, DoS, Mizoram
Nagaland	Peren	Dr. Anukul Borah, Sci-C, REC, Dimapur	Mrs. Zachivelu K. Dolie, DSO, DoS, Nagaland
Assam	Darrang	Dr. S.N. Gogoi, Sci-D, RSRs, Jorhat	Shri H.N. Goswami, Asst. Director, DoS, Darrang
	Jorhat	Smt. Mina Pamehgam, Sci-C, RSRs, Jorhat	Shri Dhrubajyoti Borah, Asst. Director, DoS, Assam
	Udalguri, BTC	Dr. Y. Debaraj, Sci-D, RSRs, Jorha	Sri H. K. Hazarika, Asst. Director, DoS, Udalguri, BTC
Tripura	Champaknagar	Dr. G. B. Singh, Sci-D, REC, Agartala	Shri Shakti Pada Bhowmik, Supdt. of Seri., DoS, Tripura
Bihar	Kishanganj	Shri Bimal Ch.Ray, Sci-D, MSED, Kishanganj	Shri N. P. Verma, Asstt. Director, DoS, Bihar, Purnea



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Progress of clusters activities during the year 2014-2015 is presented in the Table 80.

**Table 80. Cluster wise achievement.**

State	Cluster	Dfls (Lakh)				Raw silk (MT)				Yield/100 dfls (kg)	
		Target	Achievement			Tgt.	Achievement			BV	ICB
			BV	ICB	Total		BV	ICB	Total		
West Bengal	Malda	1.50	1.519	1.793	3.312	4.65	9.822	7.80	<b>17.622</b>	51.7	43.5
	Murshidabad	1.50	1.219	1.011	2.230	4.65	7.870	4.92	<b>12.790</b>	56.2	48.1
	Birbhum	1.50	0.500	3.940	4.440	4.65	2.229	1.71	<b>3.939</b>	26.3	27.6
	Nadia	1.50	0.497	3.090	3.587	4.65	2.733	9.39	<b>12.123</b>	41.0	40.1
<b>Sub-Total</b>		<b>6.00</b>	<b>3.735</b>	<b>9.834</b>	<b>13.569</b>	<b>18.60</b>	<b>22.65</b>	<b>23.82</b>	<b>46.473</b>		
Odisha	Ghatgaon	0.50	0.080	0.110	0.190	1.75	0.227	0.223	0.450	36.7	25.8
	Kashipur	0.50	0.065	0.065	0.130	1.75	0.047	0.06	0.107	14.8	10.4
<b>Sub-Total</b>		<b>1.00</b>	<b>0.125</b>	<b>0.155</b>	<b>0.280</b>	<b>3.50</b>	<b>0.274</b>	<b>0.283</b>	<b>0.557</b>		
Bihar	Kishanganj	<b>0.50</b>	<b>0.270</b>	<b>0.220</b>	<b>0.490</b>	<b>1.75</b>	<b>1.456</b>	<b>0.918</b>	<b>2.374</b>	40.3	40.9
Assam	Darrang	2.00	0.450	-	<b>0.450</b>	8.00	2.180	-	2.180	38.1	-
	Jorhat	2.00	0.422	-	<b>0.422</b>	8.00	2.121	-	2.121	40.2	-
	Udalguri	2.00	0.730	-	<b>0.730</b>	8.00	3.999	-	<b>3.999</b>	43.8	-
<b>Sub-Total</b>		<b>6.00</b>	<b>1.602</b>	<b>-</b>	<b>1.602</b>	<b>24.00</b>	<b>5.319</b>	<b>-</b>	<b>5.319</b>		
Manipur	Churach'pur	2.50	1.200	-	<b>1.200</b>	8.00	6.750	0.000	<b>6.750</b>	46.2	-
	Ukhrul	2.50	0.900	0.300	1.200	8.00	5.230	1.590	<b>6.820</b>	47.2	45.0
<b>Sub-Total</b>		<b>5.00</b>	<b>2.100</b>	<b>0.300</b>	<b>2.400</b>	<b>16.00</b>	<b>9.800</b>	<b>1.590</b>	<b>11.39</b>		
Mizoram	Aizawl	<b>2.50</b>	<b>0.815</b>	<b>-</b>	<b>0.815</b>	<b>8.00</b>	<b>4.300</b>	<b>0.000</b>	<b>4.300</b>	47.1	-
Nagaland	Peren	<b>2.00</b>	<b>0.570</b>	<b>0.225</b>	<b>0.795</b>	<b>8.00</b>	<b>2.530</b>	<b>0.787</b>	3.317	35.5	28.0
Tripura	Champ'nagr	<b>2.00</b>	<b>0.625</b>	<b>0.348</b>	<b>0.973</b>	<b>8.00</b>	<b>1.997</b>	<b>0.100</b>	<b>2.097</b>	45.0	35.6
<b>Grand total</b>		<b>25.00</b>	<b>9.842</b>	<b>11.08</b>	<b>20.924</b>	<b>87.85</b>	<b>48.33</b>	<b>27.49</b>	<b>75.827</b>	<b>44.7</b>	<b>44.3</b>



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### 13. COLLABORATIVE RESEARCH PROJECTS/ PROGRAMMES WITH OTHER INSTITUTIONS

#### 13.1. MULBERRY BREEDING AND GENETICS SECTION

##### 13.1.1.PIB 3505: Development of drought tolerant mulberry variety for rainfed sericulture. [Collaborative project with CSGRC, Hosur] (Jan., 14 to Dec., 19).

M. K. Ghosh, P.K. Ghosh, S.K. Dutta, M.V. Santa Kumar (up to 03.01.15) and M.M. Borpuzari (CSGRC, Hosur).

**Objective:** Development of drought tolerant mulberry variety.

##### Step-01: Strategic trait based crossing and raising of progeny.

Hybridization work among the desired parents was done. After the ripening of sorosis were collected sown in the nursery bed and seedlings were raised. The population of the progenies and germination are depicted in Table 81.

**Table 81. Performance of seedlings of the progenies.**

Cross combination	Seeds sown (No.)	Seedlings raised (No.)	Germination (%)
MI-0437 × ME-0125	1951	265	13.58
MI-0437 × MI-0256	6374	551	8.64
MI-0685 × MI-0314	5168	352	6.81
MI-0685 × MI-0308	5726	160	2.79
MI-0828 × ME-0125	3214	367	11.42
MI-0827 × MI-0012	411	159	38.69
MI-0762 × ME-0065	4838	40	0.83
MI-0763 × MI-0012	4840	763	15.76
MI-0477 × ME-0016	476	47	9.87
MI-0437 × MI-0670	3839	485	12.63

#### 13.2. AGRONOMY SECTION

##### 13.2.1. PPF: 3532. Assessment, development and management of area under mulberry in major sericulture districts of West Bengal using geo-spatial technique. [Collaborative project with NESAC, Meghalaya.] (Feb.,15 to Jan.,17).

M. Chaudhuri and B. K. Handique (SE-E, ISRO, NESAC) Jonali Goswami (SE-E, ISRO, NESAC), P. T. Das (SE-D, ISRO, NESAC) and C. Goswami (SE-D, ISRO, NESAC).

**Objective:** To estimate the current spatial extent of mulberry cultivation in selected blocks of 4 major mulberry growing districts of West Bengal using Remote Sensing, Geographic Information System (GIS) and Global Positioning Systems (GPS). Crop condition assessment of existing mulberry plantation. Estimate leaf protein and moisture contents using hyperspectral data with limited laboratory based analysis. To develop block



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specific MIS which can be integrated with SILKS portal for dynamic visualization and decision making.

Satellite images of mulberry expanse were procured from NRSC, Hyderabad and project work initiated.

### **13.3. SILKWORM PHYSIOLOGY & RTI SECTION**

**13.3.1. APS 3497: Studies on the environmental effect on P1 rearing, its' grainage performance followed by commercial rearing of silkworm *Bombyx mori* L., during unfavourable seasons of West Bengal.** [in collaboration with NSSO] (May, 13 to Apr., 15).

A. K. Saha, T. Datta (Biswas) (up to June, 14), L. M. Saha and B. C. Ray.

**Objectives:** Determination of the effect of environmental factors on P1 seed crop rearing during adverse crop seasons at farmers' level and its subsequent effects on commercial grainage performance and finally on commercial rearing at farmers' level.

Ten P1 farmers under SSPC, Berhampore were selected from two villages Banjetia and Kalitala Diar, Murshidabad @ 5 farmers / village in consultation with SSPC, Berhampore.

**E01: Studies on the effect of temperature and humidity on P1 rearing during unfavorable seasons.**

During P1, [July-Aug., 2014 (Ashwina)] crop season, cocoon yield of 30 kg and 31.5 kg/100 dfls were recorded with Nistari and M12W respectively at the Institute level.

**E02: Studies on the effect of temperature and humidity prevailing during P1 rearing on commercial grainage performance.**

Grainage performance of P1 Ashwina crop showed egg recovery of 52.5 gm per 1kg cocoon at Institute level.

**E03 : Studies on the effect of temperature and humidity prevailing during P1 rearing on subsequent commercial rearing at farmers' level.**

Commercial rearing conducted with the dfls produced at Institute level resulted in cocoon yield of 29kg /100dfls. Four crops conducted so far depicted the importance of environmental factors such as temperature and relative humidity not only on the P1 seed crop but also its subsequent effects on commercial grainage performance and finally on commercial rearing.



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### 14. CONTINUOUS AND ROUTINE PROGRAMME

#### 14.A.MAIN INSTITUTE

##### 14.A.1. BPI(P)025: Maintenance of mulberry Germplasm Bank at CSR&TI, Berhampore (W.B.).(Jan., 14 to Dec., 18). (Continuous).

M.K. Ghosh, P.K.Ghosh, S K Dutta and MV Santha Kumar (up to 03.01.15).

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

A total of 301 mulberry accessions comprising of 159 germplasm accessions, 33 triploids, 29 tetraploids and 80 elite lines of C-line and S-lines were maintained. Category wise leaf yield data were recorded per plant during June, 2014.

**Table 82. Leaf yield (kg/plant) of GPB Accessions:**

Category	Leaf yield (kg/plant)				
	Triploid	Tetraploid	GPB	C Line	S Line
Maximum	10.294 (Tr-5)	9.171 (T-13)	16.108 (China white)	6.342 (C-530)	10.083 (S-1704)
Minimum	0.634 (Tr-12)	0.285 (T-2)	0.298 (Aroso)	0.216 (C-1667)	0.201 (S-1681)
Average	3.290	2.419	3.496	1.389	2.528
CD at 5%	0.255	0.287	0.675	0.293	0.426

##### 14.A.2.BPP(RP)001:Mother culture maintenance of *Azotobacter chroococcum* and mass multiplication for “Nitrofert” production (Continuous).

S. Rajaram

**Objective:** To reduce Nitrogenous chemical fertilizer requirement and expenditure to sericulture farmers in mulberry cultivation. To protect and improve soil health conditions in mulberry garden for sustainable productivity.

A total of 1182 kg Nitrofert produced and supplied to 225 farmers covering 147.75 acres of mulberry plantation.

##### 13.A.3.BPP(RP) 002:Mother culture maintenance of *Glomus moseae* [Arbuscular Micorrhizal Fungus (AMF)] and mass multiplication for “Phosphofert” production (Continuous).

S. Rajaram

**Objective :** To reduce Phosphorous chemical fertilizer and expenditure on the same to sericulture farmers in mulberry cultivation.To protect and improve soil health conditions in mulberry garden for sustainable productivity.

A total of 1086 kg Phosphofert were produced and supplied to 85 new farmers covering 36 acres of mulberry plantation.



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### 14.A..4. BAI(RP)003: Maintenance of bivoltine and multivoltine germplasm and newly developed breeds and their lines. (Apr., 13 to Mar., 14) (Continuous).

N. Suresh Kumar, A. K. Verma and A. K. Saha.

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

A total of 24 Multivoltine and 35 Bivoltine silkworm breeds/ strains were maintained as stock lots (Table 83 & 84).

**Table 83. Performance of multivoltine germplasm.**

Sl. No.	Breed	Fecundity (No.)	Hatching (%)	ERR (kg)	Pup. (%)	SCW (g)	SSW (g)	Shell %
1	Nistari (M)+p	425	93.4	10.45	90.8	1.085	0.135	12.44
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-95</b>	<b>9-11</b>	<b>85-91</b>	<b>0.9-1.1</b>	<b>0.100-0.125</b>	<b>11-13</b>
2	Nistari (P) p	421	97.8	9.85	91.8	1.055	0.125	11.85
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-98</b>	<b>9-10</b>	<b>85-91</b>	<b>0.9-1.1</b>	<b>0.100-0.125</b>	<b>11-13</b>
3	Chalsa	432	95.6	9.35	89.7	1.210	0.166	13.72
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>0.9-1.2</b>	<b>0.125-0.150</b>	<b>11-13</b>
4	Sarupat	395	92.8	9.28	88.5	1.148	0.135	11.76
	<b>Bench Mark</b>	<b>350-400</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>0.9-1.1</b>	<b>0.120-0.145</b>	<b>11-13</b>
5	Pure (PM)	396	96.4	9.23	87.5	1.236	0.159	12.86
	<b>Bench Mark</b>	<b>350-400</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>0.9-1.3</b>	<b>0.120-0.150</b>	<b>11-13</b>
6	G	510	94.5	9.88	89.5	1.398	0.189	13.52
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>1.12-1.35</b>	<b>0.17-0.20</b>	<b>12-14</b>
7	M2	435	93.7	9.86	87.5	1.318	0.177	13.42
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>1.12-1.25</b>	<b>0.17-0.200</b>	<b>12-14</b>
8	O (Oval)	500	96.5	9.75	88.3	1.515	0.220	14.52
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>1.12-1.5</b>	<b>0.170-0.225</b>	<b>12-15</b>
9	CB5	445	95.2	9.87	88.8	1.268	0.160	12.62
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>1.12-1.15</b>	<b>0.15-0.17</b>	<b>12-14</b>
10	Cambodge	405	92.7	9.56	88.2	1.040	0.127	12.21
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>1.10-1.12</b>	<b>0.10-0.12</b>	<b>12-14</b>
11	M12W	434	91.8	8.72	88.4	1.156	0.147	12.72
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>1.10-1.12</b>	<b>0.11-0.15</b>	<b>12-14</b>
12	M6M81	515	95.4	9.88	87.2	1.328	0.191	14.38
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>1.10-1.32</b>	<b>0.15-0.19</b>	<b>12-14</b>
13	M9A	456	94.4	9.57	87.6	1.441	0.200	13.88
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>1.12-1.45</b>	<b>0.15-0.19</b>	<b>12-14</b>
14	M6DPC	455	95.6	9.54	88.8	1.152	0.158	13.72
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>1.10-0.12</b>	<b>0.15-0.19</b>	<b>12-14</b>
15	M6DP(Gc)	436	96.5	9.96	85.7	1.282	0.175	13.65
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-95</b>	<b>9-10</b>	<b>80-85</b>	<b>1.10-0.12</b>	<b>0.15-0.19</b>	<b>12-14</b>
16	M6DPC(E)	485	93.8	9.72	88.9	1.415	0.196	13.85
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-95</b>	<b>9-10</b>	<b>80-85</b>	<b>1.12-0.14</b>	<b>0.15-0.19</b>	<b>12-14</b>



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17	M15	455	94.8	9.60	85.7	1.125	0.152	13.51
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-95</b>	<b>9-10</b>	<b>80-85</b>	<b>1.12-0.14</b>	<b>0.15-0.19</b>	<b>12-14</b>
18	M.Con.1	515	95.4	9.65	88.6	1.415	0.239	16.89
	<b>Bench Mark</b>	<b>500-550</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>1.12-0.14</b>	<b>0.15-0.19</b>	<b>12-14</b>
19	M.Con.4	555	95.7	10.16	88.5	1.495	0.238	15.92
	<b>Bench Mark</b>	<b>500-550</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>1.12-0.14</b>	<b>0.15-0.19</b>	<b>12-14</b>
20	OS616	535	92.8	9.72	85.5	1.248	0.168	13.46
	<b>Bench Mark</b>	<b>500-550</b>	<b>90-95</b>	<b>9-10</b>	<b>85-90</b>	<b>1.12-0.14</b>	<b>0.15-0.19</b>	<b>12-14</b>
21	M12(W)-Auto-sex +p Female	425	92.6	8.82	82.1	1.195	0.151	12.64
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-95</b>	<b>9-10</b>	<b>80-85</b>	<b>1.12-0.14</b>	<b>0.15-0.19</b>	<b>12-14</b>
22	M12W ( Auto-sex) Dirty female	385	91.8	8.22	82.7	1.135	0.150	13.22
	<b>Bench Mark</b>	<b>350-400</b>	<b>90-95</b>	<b>9-10</b>	<b>80-85</b>	<b>1.12-0.14</b>	<b>0.15-0.19</b>	<b>12-14</b>
23	Nistari (Auto-sex) Yellow cocoon (Y) Female	442	94.4	8.98	82.4	1.212	0.155	12.79
	<b>Bench Mark</b>	<b>400-450</b>	<b>90-95</b>	<b>9-10</b>	<b>80-85</b>	<b>1.12-0.14</b>	<b>0.15-0.19</b>	<b>12-14</b>

**Table 84. Rearing performance of bivoltine silkworm germplasm.**

Sl. No.	Breed	Fecundity (No.)	Hatching (%)	ERR (kg)	Pup. (%)	SCW (g)	SSW (g)	Shell %
1	KPG-A	501	95.7	12.75	88.2	1.445	0.262	18.13
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>10-12</b>	<b>85-90</b>	<b>1.35-1.45</b>	<b>0.25-0.29</b>	<b>15-19</b>
2	KPG-B	510	95.2	12.58	82.8	1.600	0.305	19.06
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>10-12</b>	<b>85-90</b>	<b>1.50-1.65</b>	<b>0.25-0.30</b>	<b>15-19</b>
3	KPG-11	498	96.5	13.11	83.2	1.385	0.262	18.92
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>10-13</b>	<b>85-90</b>	<b>1.350-1.40</b>	<b>0.25-0.30</b>	<b>15-19</b>
4	P5	505	95.4	13.35	85.7	1.595	0.298	18.68
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>10-13</b>	<b>85-90</b>	<b>1.50-1.65</b>	<b>0.25-0.30</b>	<b>15-19</b>
5	SH-6	495	96.3	15.21	83.1	1.491	0.265	17.77
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>13-15</b>	<b>85-90</b>	<b>1.50-1.65</b>	<b>0.25-0.30</b>	<b>15-19</b>
6	SK3	505	95.4	15.12	87.5	1.565	0.285	18.21
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>13-15</b>	<b>85-90</b>	<b>1.50-1.65</b>	<b>0.25-0.30</b>	<b>15-19</b>
7	SK4	498	96.2	12.46	88.5	1.495	0.269	17.99
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>13-15</b>	<b>85-90</b>	<b>1.50-1.65</b>	<b>0.25-0.30</b>	<b>15-19</b>
8	D5	496	96.1	12.67	88.6	1.515	0.288	19.01
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.50-1.65</b>	<b>0.25-0.30</b>	<b>15-19</b>
9	D6M	525	95.6	13.56	91.1	1.508	0.286	18.97
	<b>Bench Mark</b>	<b>500-550</b>	<b>90-95</b>	<b>13-15</b>	<b>85-90</b>	<b>1.50-1.65</b>	<b>0.25-0.30</b>	<b>15-19</b>
10	D6p	498	95.4	16.91	88.8	1.770	0.345	19.49
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>15-17</b>	<b>85-90</b>	<b>1.50-1.65</b>	<b>0.28-0.35</b>	<b>15-19</b>
11	BHR1	497	96.1	14.79	88.8	1.571	0.302	19.22
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.50-1.65</b>	<b>0.25-0.30</b>	<b>15-19</b>
12	BHR 2	515	96.1	13.87	87.8	1.614	0.306	18.96
	<b>Bench Mark</b>	<b>500-550</b>	<b>90-95</b>	<b>13-15</b>	<b>85-90</b>	<b>1.50-1.65</b>	<b>0.25-0.30</b>	<b>15-19</b>
13	BHR3	498	96.4	14.31	90.5	1.730	0.322	18.61
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>15-17</b>	<b>85-90</b>	<b>1.50-1.65</b>	<b>0.28-0.35</b>	<b>15-19</b>
14	MJ 1	495	96.2	13.13	88.8	1.435	0.275	19.16
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.40-1.45</b>	<b>0.25-0.30</b>	<b>15-19</b>
15	MJ 2	501	95.5	13.58	91.1	1.440	0.265	18.40
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.40-1.45</b>	<b>0.25-0.30</b>	<b>15-19</b>
16	MC4(E)	498	96.4	13.95	88.8	1.512	0.282	18.65
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.45-1.50</b>	<b>0.25-0.30</b>	<b>15-19</b>



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17	MC4(O)	485	94.6	13.67	88.7	1.450	0.267	18.41
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.40-1.45</b>	<b>0.25-0.30</b>	<b>15-19</b>
18	MC2	486	93.7	11.29	87.5	1.460	0.276	18.90
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.40-1.45</b>	<b>0.25-0.30</b>	<b>15-19</b>
19	BG(W)	495	96.1	13.55	90.5	1.460	0.268	18.36
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.40-1.45</b>	<b>0.25-0.30</b>	<b>15-19</b>
20	YB	520	93.6	12.22	88.5	1.420	0.250	17.61
	<b>Bench Mark</b>	<b>500-550</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.40-1.45</b>	<b>0.25-0.30</b>	<b>15-19</b>
21	NB18	505	95.4	13.44	88.5	1.650	0.302	18.30
	<b>Bench Mark</b>	<b>500-550</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.40-1.45</b>	<b>0.25-0.30</b>	<b>15-19</b>
22	Chinese(PN)	495	95.2	13.25	87.8	1.555	0.298	19.16
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.50-1.55</b>	<b>0.25-0.30</b>	<b>15-19</b>
23	JPN	500	95.3	13.55	91.5	1.365	0.270	19.78
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.30-1.35</b>	<b>0.25-0.30</b>	<b>16-20</b>
24	NB4D2	502	95.6	12.14	88.1	1.610	0.312	19.38
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.50-1.55</b>	<b>0.25-0.30</b>	<b>16-20</b>
25	CSN	485	95.4	13.74	88.7	1.375	0.262	19.05
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.30-1.35</b>	<b>0.25-0.30</b>	<b>16-20</b>
26	SK3C	485	96.2	14.95	88.8	1.400	0.266	19.00
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.35-1.40</b>	<b>0.25-0.30</b>	<b>16-20</b>
27	SK4C	505	95.6	13.55	88.5	1.650	0.308	18.67
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.50-1.55</b>	<b>0.25-0.30</b>	<b>16-20</b>
28	SK3N	565	96.2	13.93	88.8	1.430	0.275	19.23
	<b>Bench Mark</b>	<b>550-600</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.50-1.55</b>	<b>0.25-0.30</b>	<b>16-20</b>
29	SK4N	485	96.5	14.02	92.2	1.430	0.284	19.86
	<b>Bench Mark</b>	<b>450-500</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.40-1.45</b>	<b>0.25-0.30</b>	<b>15-19</b>
30	D6(PN)	565	97.1	13.57	89.5	1.490	0.288	19.33
	<b>Bench Mark</b>	<b>500-550</b>	<b>90-95</b>	<b>11-13</b>	<b>85-90</b>	<b>1.45-1.50</b>	<b>0.25-0.30</b>	<b>15-19</b>
31	SK6	548	96.2	14.55	90.8	1.660	0.324	19.52
	<b>Bench Mark</b>	<b>500-550</b>	<b>90-95</b>	<b>11-15</b>	<b>85-90</b>	<b>1.55-1.65</b>	<b>0.28-0.35</b>	<b>17-20</b>
32	SK7	545	96.4	15.26	91.1	1.650	0.315	19.01
	<b>Bench Mark</b>	<b>500-550</b>	<b>90-95</b>	<b>13-16</b>	<b>85-90</b>	<b>1.55-1.65</b>	<b>0.28-0.35</b>	<b>17-20</b>
33	B.Con.1	525	95.7	15.14	91.7	1.560	0.296	18.97
	<b>Bench Mark</b>	<b>500-550</b>	<b>90-95</b>	<b>13-16</b>	<b>85-90</b>	<b>1.55-1.65</b>	<b>0.28-0.35</b>	<b>17-20</b>
34	B.Con.4	538	95.7	15.31	91.5	1.575	0.302	19.17
	<b>Bench Mark</b>	<b>500-550</b>	<b>90-95</b>	<b>13-15</b>	<b>85-90</b>	<b>1.55-1.65</b>	<b>0.28-0.35</b>	<b>17-20</b>

### 14.B.RSRS

#### 14.B.1.B-KPG(RP)008: Maintenance of bivoltine silkworm germplasm. (Continuous).

R. Bhutia (up to June, 2014) and C. Maji

**Objective:** To maintain the bivoltine silkworm breeds true to their original racial characters and to study their qualitative and quantitative traits.

A total of 81 Bivoltine breeds of different agro-climatic origin were maintained as Bivoltine Germplasm Stock lot at RSRS Kalimpong. Rearing of the same was conducted during spring crop (April-May) 2014. Dfls of each breed were kept under aestivation.



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### **14.B.2.BKG(RP)011: Multiplication and supply of SK6 x SK7 dfls to Sikkim and plain area** (Apr., 2012 – continue).

C. Maji (PI), M. D. Maji and S. T. Lepcha.

**Objective:** Production of SK hybrid dfls and supply to the farmers and other organizations.

Thirty dfls of SK6 and 25 dfls of SK7 were reared during spring, harvested 18.7 kg and 11.2 kg cocoons with 62.4 kg and 44.4 kg /100 dfls, respectively. During Summer 15 dfls each of SK6 and SK7 were reared and harvested 10.8 kg and 12.4 kg cocoons @ 72 kg and 82.67 kg /100 dfls, respectively. During Autumn, 40 dfls each of SK6 and SK7 were reared and harvested 26 kg and 27.8 kg cocoons @ 65 kg and 69 kg /100 dfls, respectively. Grainage conducted and a total of 5945, 3963 and 10162 dfls of SK6 hybrid produced during spring, summer and autumn crop respectively and total 11,870 dfls were supplied to DoS, Sikkim.

### **14.B.3.B-RNC(RP) 004: Survey and Surviellance of disease and pest of mulberry and silkworm** (Continuous).

M. Alam

**Objective:** To assess the incidence of different diseases periodically and in case of crossing economic threshold level to take protective and curative measures to check the outbreak of diseases.

Incidence of grasserie was recorded 1%, 4.5% and 2.25% during Feb.-March, August and October seasons, respectively at farmers' field. Mulberry disease viz. powdery mildew was recorded least with range of 0.25 to 0.49 PDI during Sept., 14 and January, 15. No incidence of other diseases was recorded.

### **14.B.4.2. B-JRH(RP) 009: Survey and Surveillance of Mulberry and Silkworm Pests & Diseases of N.E. States.** (Oct., 13 to Sept., 16).

M. Pamehgam

**Objective:** To monitor the incidence of various diseases and pests of mulberry and silkworm in the region throughout year. To records meteorological data and correlate the same with the data collected. To recommend remedial measures. To develop forecasting models for various pests & diseases.

**Mulberry diseases:** Incidence of leaf spot (1.7 PDI) was max. during October in Meghalaya followed by Nagaland (0.9 PDI) and Assam (0.04PDI). Powdery mildew was max. in Mizoram (13.1PDI) followed by Nagaland (8.2PDI) and Manipur (0.2 PDI). High intensity of Leaf rust was recorded in Mizoram (5.5 PDI). **Mulberry Pests:** Mealy bug infestation (No./shoot was max. (4.7-0.3) in Assam followed by Agartala (3.1- 0.2). Peak incidence of whitefly was 18.8 no/plant in Tripura followed by Imphal (12). Thrips infestation was observed only in Assam (2.5 no/ leaf)

**Silkworm diseases:** High incidence of Grasserie was during September in Tripura (28.2%) and Shillong (6.9%). Muscardine (1.2%) was observed only in Meghalaya.



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### 15. TRAINING PROGRAMME CONDUCTED

#### 15.A. MAIN INSTITUTE

##### 15.A.1. POST GRADUATE DIPLOMA IN SERICULTURE (MULBERRY):

**Duration:** 15 months

Subhra Chanda, Jalaja S. Kumar, Zakir Hossain and D. Chakravarty (fr. 09.10.2014).

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

A batch comprising of 29 students (Session: 2013-14) were successfully completed PGDS course by 30<sup>th</sup> Sept., 2014 and the next batch of 15 students (Session: 2014-15) were undergoing training. The course is affiliated under the University of Kalyani, West Bengal.

##### Details of Post Graduate Diploma in Sericulture (Mulberry):

Sl. No.	Sponsoring Agencies	No. of candidates	
		Session 2013-14 Completed on 30.09.2014	Session-2014-15 Started on 01.07.2014
1	Govt. of Manipur	13	06
2	Govt. of Nagaland	01	03
3	Govt. of Assam	05	05
4	Govt. of Tripura	06	-
5	Govt. of A.P.	01	-
6	Govt. of Jharkhand	-	01
7	Direct admission	03	-
<b>Total:</b>		<b>29</b>	<b>15</b>



##### 15.A.2. NON-STRUCTURED TRAINING COURSE

###### 15.A.2.1. SUP Training Programme:

**Duration:** 5 to 10 days.

Jalaja S. Kumar, Zakir Hossain, S. Chanda and D. Chakravarty (fr. 09.10.2014).

**Objective:** The objective of SUP is to impart practical training to the lead farmers about application of sericulture technologies in their enterprise.

Skill Updating Programme (SUP) for farmers was initiated under Central Sector Scheme (CSS). A total of 112 candidates were imparted training under SUP in different disciplines as given below:



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### Details of SUP courses conducted

Course	Duration (Days)	Trained (No.)
Chawki Silkworm Rearing Technique.	10	32
Mulberry varieties, cultivation technique and vermi- composting.	5	37
Integrated disease & pest management components & concepts.	5	43
<b>Total:</b>	<b>-</b>	<b>112</b>



**Fig.1.** Leaf plucking by trainees under SUP.

**Fig.2.** Trainees feeding the chawki worms.

**Fig.3.** Theory class of trainees.

**Fig.4.** Validation is going on.

### 15.A.3. INTEGRATED SKILL DEVELOPMENT SCHEME (ISDS):

**Duration:** Nov., 2011 to Oct., 2016

Zakir Hossain, Jalaja S. Kumar, S.Chanda and D. Chakravarty (fr. 09.10.2014).

In view of the urgent need to upgrade the skills of textile workers and to develop competitiveness in the textile industry, the Ministry of Textiles, Govt. of India has launched Integrated Skill Development Scheme (ISDS) wherein Central Silk Board has been included as an implementing agency. At this Institute, the ISDS envisages to train youth/women in the fields of mulberry cultivation, commercial silkworm rearing, cocoon handicrafts, cocoon reeling and spinning skill updating of extension agents. The trainees will be identified and selected through interview in consultation with the local government bodies.

**Objective:** To train and motivate rural/semi-urban youth/women for developing employable skill in them to start sericulture based enterprise. To empower the rural youths/women with entrepreneurial and managerial skills. To address the shortage of trained manpower and to tap the huge employment potential.

### Details of ISDS courses conducted

Sl. No.	Name of the course	Duration (Days)	Sponsoring authority	Persons (No.)
1.	Mulberry cultivation.	15	Through interview in consultation with the local government bodies.	103
2.	Commercial Silkworm rearing.	15		241
3.	Cocoon reeling & spinning.	15		61
<b>Total</b>				<b>405</b>



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<b>Fig.1.</b> ISDS trainees are giving attendance in biometric machine.	<b>Fig.2.</b> Farmers are visiting rearing room of DoS, Kotasur.	<b>Fig.3.</b> Practical examination of ISDS trainees is going on.	<b>Fig.4.</b> Prize distribution to ISDS trainees by Dr. S. Nirmal Kumar, Director.

### 15.A.4. NEED BASED TRAINING PROGRAMME CONDUCTED ON THE REQUEST OF DIFFERENT AGENCIES

Jalaja S. Kumar, S. Chanda, Zakir Hossain and D. Chakravarty (fr. 09.10.2014).

#### Details of Adhoc training programmes conducted

#	Course	Durati on (Days)	Sponsoring authority	Persons trained	Objective
1.	Beneficiary Empowerment Programme for Farmers.	2-5	DoS Jharkhand Odisha and Assam	108	To impart basic knowledge on sericulture and for exposure on latest technologies developed by the Institute to the farmers of concerned state.
2.	Orientation Training Programme for in service candidates.	5	Central Silk Board	16	To impart training on latest technologies developed to the in service candidates who joined this Institute from other units.
3.	Orientation Training Programme on crop insurance.	2	Central Silk Board	12	To impart training on latest technologies and various activities of sericulture to employees of insurance companies.
4.	Training Programme on “Examination of mother moth and Acid Treatment.”	3	DoS, West Bengal and Central Silk Board	41	To impart training on disinfection, maintenance of hygiene, identification of different diseases of mother moths and acid treatment.



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5.	Refresher Course Training Programme for Scientists.	5	Central Silk Board	19	To impart training on new technologies and to refresh the knowledge on different fields related aspects concerning sericulture.
6.	Hands on training on Income Tax Package.	3	Central Silk Board	25	
7.	Trainers' Training Programme	14	DoS, Manipur	90	To impart training on latest technologies developed by the Institute to the officers & officials under DoS, Manipur for implementation of MSP under NERTPS.
8.	On job Training Programme.	3-14	TDB College, Raniganj & K. N. College, Berhampore	40	To impart training on latest technologies concerning sericulture to the college students.
9.	Reeling Training under NFM (BRGF).	13	DoS, West Bengal	29	To impart practical training to the reelers of Murshidabad district about the latest technologies for benefit of the stakeholders.
10.	Refresher Training under Seed Act to Chawki Silkworm Rearers.	7	NSSO	17	To impart training to the registered chawki rearers about the latest technologies for benefit of the stakeholders.
Total:		-	-	<b>397</b>	-

			
<b>Fig.1.</b> Theory class of the trainees under Crop Insurance prog.	<b>Fig.2.</b> Trainees under Seed Act engaged in chawki rearing.	<b>Fig.3.</b> Practical training for trainees under TTP, Manipur.	<b>Fig.4.</b> Reelers under NFM being trained.

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### 15.A.5. ORGANISATION OF TRAINING PROGRAMMES FOR FARMERS AND STAFF OF NORTH EASTERN REGION

D. Chakravarty (w.e.f. 09.10.2014), Jalaja S. Kumar, Zakir Hossain and S. Chanda.

#### A. Training programme for farmers:

The farmers of NE region required to be trained in the latest technologies in sericulture for improving their productivity and making sericulture sustainable. A programme to this effect was drawn for 2014-15 with a budget outlay of 75 lakhs with a target of training 1500 farmers of different bivoltine clusters from the North Eastern region. A total of 1536 farmers were trained under this programme as detailed below.

#### Details of farmers trained under various clusters of NE region

State	Cluster	Farmers (No.)	
		Target	Achievement
Assam	Jorhat	200	200
	Darrang	220	256
	Udalguri	160	160
Manipur	Churachandpur	160	160
	Ukhrul	160	160
Mizoram	Aizawl	180	180
Nagaland	Peren	160	160
Tripura	West Tripura	120	120
Meghalaya	Shillong	60	60
Arunachal Pradesh	Namsai	40	40
Sikkim	Rangpo	40	40
	<b>Total</b>	<b>1500</b>	<b>1536</b>

**B. Training programme for staff:** The staff belonging to different State Sericulture Departments in North Eastern region were trained in sericulture for effective transfer of technologies. During the period, 161 officials were trained. The details are given below.

#### Details of officials trained of NE region:

State	Officials (Nos.)	
	Target	Achievement
Assam	70	56
Manipur	45	45
Mizoram	30	30
Tripura	30	30
<b>Total</b>	<b>225</b>	<b>161</b>



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### 15. B. REGIONAL SERICULTURAL RESEARCH STATION

#### 15.B.1. KALIMPONG

##### 15.B.1. Trainers Training Programme (TTP):

C. Maji, M. D. Maji, S. Chatterjee and R. L. Ram.

One day Trainers Training Programme (TTP) was conducted at RSRS, Kalimpong with 11 progressive farmers on 22.08.14. The trainees were imparted training on different aspects of chawki rearing for bivoltine silkworms.

##### 15.B.2. Farmers' Training Programme (FTP):

S. Chatterjee, C. Maji and R. L. Ram.

One day Farmers Training Programme (FTP) was organized on 16.08.2014 at RSRS, Kalimpong to update knowledge level of seri-farmers of Kalimpong area on different aspects of silkworm rearing and mulberry cultivation managements.

##### 15.B.3. Integrated Skill Development Scheme (ISDS) Programme:

**Duration:** July, 14 to March, 15.

**Scientists:** C. Maji, R. L. Ram, M. D. Maji and S. Chatterjee.

##### Details of ISDS conducted:

Sl. No.	Course	Duration (Days)	Sponsoring authority	Trained (No.)
1.	Mulberry cultivation	22.07.14 to 05.08.14 (15 days)	DoT (Seri), Siliguri and Kalimpong, West Bengal	14
2.	Silkworm Rearing	19.02.15 to 05.03.15 (15 days)	DoT (Seri), Kalimpong, West Bengal	14
<b>Total</b>				<b>28</b>



Participants and faculties of First batch training on Mulberry Cultivation under ISDS programme from 22.07.2014 – 05.08.2014.



Participants and faculties of Second batch training on Silkworm Rearing under ISDS programme from 19.02.2015 – 05.03.2015.

#### 15.B.2. KORAPUT (ODISHA)

**15.B.2.1. Trainers' Training Programme:** A Trainers' Training Programme was organized at REC, Bademarenga (Chhattisgarh) on 7<sup>th</sup> Jan., 2015 to impart training to the technical personnel of DOS, Chhattisgarh, on soil testing and its reclamation, Integrated Package of Practices for Mulberry cultivation, Disinfectants and disinfection procedure for a successful rearing and New technologies of silkworm rearing and management.



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**15.B.2.2. Farmers' Training Prog.:** A total of 33 farmers were trained in three Farmers Training Prog. at RSRS, Koraput on 04.07.2014 (7 farmers), 05.10.2014 (12 farmers) and 24.12.2014 (14 farmers) of Lamtaput block of Koraput and Kashipur block of Rayagada districts, Odisha.

**15.B.2.3. Farmers Field School:** With two lead farmers Shri Suredra Majhi and Shri Birendra Majhi, Chandragiri village in Kashipur Block, Rayagada district, 8 sittings were organized and a total of 122 farmers were attended.

**15.B.2.4. Integrated Skill Development Prog.:** ISDS Training prog. with 15 farmers per batch for 15 days were organized.

**15.B.2.5. Farmers' Training Programme under Beneficiary Empowerment Prog.:** A total of 75 farmers were trained in two Farmers Training Prog. for 5 days each at RSRS, Koraput on 16.02.2015 to 21.02.2015 (20 Farmers) and 23.02.2015 to 28.02.2015 (55 farmers) from Daspalla area and Koraput and Rayagada districts, Odisha, respectively.

### **15.C.3. JORHAT (ASSAM)**

**15.C.3.1. Trainers' Training Programme:** No. of persons trained: 6 Nos.

A training programme for 7 days was organized at RSRS, Jorhat. A total of 6 DoS, Assam officials of Jorhat district and DoS, Nagaland were trained in various aspects like mulberry plantation, silkworm rearing, chawkie rearing, disinfection of rearing room, black boxing, disease and pest management.

**15.C.3.2. Farmers Training Prog.:** A total of 863 farmers of N.E. states were trained in various aspects such as, mulberry plantation, silkworm rearing, chawkie rearing, disinfection of rearing room, black boxing, disease and pest management etc. are as follows:

Unit	Target	Achievement. Prog; Beneficiaries
RSRS, Jorhat	30 farmers	30 farmers
REC, Agartala; No. of beneficiary	3 programme	3; 128
REC, Aizawl; No. of beneficiary	3 programme	5; 168
REC, Dimapur; No. of beneficiary	3 programme	5; 140
REC, Imphal; No. of beneficiary	3 programme	5; 146
REC, Shillong; No. of beneficiary	3 programme	5; 251

### **15.C.3.3. ISDS Training Programme:**

A batch of 15 farmers at RSRS, Jorhat, two batches of 35 farmers (15+ 20) at REC, Agartala, two batches of 35 farmers (15+20) at REC, Imphal and two batches of 35 farmers (15+20) at REC, Aizawl were trained during October to March, in various aspects namely mulberry cultivation and commercial silkworm rearing.



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### 16. Important Delegation lead or Participated:

Smt. Soma Bhattacharya, IAS, Textile, Govt. of West Bengal and Shri Rao, DM, Murshidabad visited this Institute on laid foundation stone of cold storage. They also



progress of MGNREGA activities and developed by CSR&TI,



Commissioner of Y.B.Ratnakar 21.07.2014 and inspected the the work of and sericulture the technologies the scientists of Berhampore.

Smt. Bangalore visited this Institute and sericulture 12.09.2014. She has inaugurated rearing house rearing, Vedeo Conference hall, re-modulated Biotechnology section and silkworm chamber at the Institute. She had interaction scientists of the Institute on R&D interventions North-Eastern region.

Smt. IAS, Secretary,



Ishita Roy, Member CSB, stakeholders on for Bivoltine computer room, incubation with the for Eastern &



A team of 5 delegates of Bangladesh Sericulture Development Board, Rajshahi, Bangladesh including the Director General, Shri Swapan Kumar Pal, visited this Institute on 29.11.2015. The team had interaction with the scientists of the Institute and exchanged views on R&D developments. They also urged for collaborative with CSR&TI, Berhampore and BSDB for development of Sericulture in Bangladesh.



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### 17. RESEARCH PUBLICATIONS

Sl. No.	Particulars	Total
I.	Research papers: A. International journals B. National journals	10 10
II.	Research articles	14
III	News/ reports/silk briefs	38
IV	Books/Book Chapters/ Booklet	18
V	Compendium of technologies	02
VI	Brochurs/ Pamphlets/ Bulletins/ Calenders	
	A. Brochurs	03
	B. Pamphlets	16
	C. Bulletins	01
	D. Manuals	03
	E. Leaflet	09
	Total	124

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3. Arora, V., Ghosh, M. K. and Gangopadhyay, G. (2014). SSR Markers for assessing the hybrid nature of two high yielding mulberry varieties. *International Journal of Genetic Engineering and Biotechnology*. **5(2)**:191-196.
4. Banerjee, R., Chattopadhyay, S., Das, N. K., Doss, S. G., Saha, A.K. and Nirmal Kumar, S. (2014). Combining ability analysis for bacterial leaf spot resistance, leaf yield and agronomic traits in mulberry clones. *Taylor & Francis*. **28 (3)**: 305-322.
5. Chattopadhyay, S., Sangma, C. D., Tikader, A., Rajan, R.K. and Bindroo, B.B. (2014). Assessment of som (*Persea bombycina*) clones for resistance against *Phyllosticta persae*. *Tropical Plant Pathology*. **39(3)**: 259-264.
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7. Ghosh, M.K., Kar, R., Dutta, S.K., Ghosh, P.K. and Nirmal Kumar, S. (2015). Nitrogen harvest index and biological yield for screening of better genotypes in mulberry (*Morus* spp.). *Bioscience Discovery*. **6(1)**: 1-5.
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### **National:**

1. Acharya, A., Allay, S., Ram, R. L. and Chakraborty, B. N. (2014). Physico-chemical analysis of rhizospheric soil, mycorrhizal association and root colonization of Mulberry (*Morus alba* L) plants grown in Kalimpong hills. *NBU Journal of Plant Sciences*, **8(1)**: 5-12. ISSN: 0974-6927.
2. Chanda, S., Saha, L. M., Ronibala Devi, Khwairakpam and Mandal, K. (2014). Effect of cold storage of female pupae of silkworm *Bombyx mori* L. on survivability and reproductive behavior. *Eco. Env. & Cons.*, **20(4)**: 1699-1704.
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3. Das, D., Santha Kumar, M. V., Mukhopadhyay, S. K. and Bindroo, B. B. (2014). Success story – Sericulture made my life – Smt. Kusumbala Mondal. *Indian Silk*. **5 (2-4):** 32.
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5. Rajaram, S., Nirmal Kumar, S. and Roy Chowdhuri (2014) Actual water requirement for mulberry crop and impact of excess application through traditional irrigation system for the crop under West Bengal condition. **Abs-73**. pp. 140-141.
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7. Saha, A.K., Chakraborty, S., Suresh Kumar, N., Verma, A. K. and Nirmal Kumar S. (2014). Comparative study on morphometric change during ontogenic development of female reproductive system of multivoltine and bivoltine breed of *Bombyx mori* L. **Abs-75**. p.143.
8. Santha Kumar, M.V., Lalitha, N., Patnaik, M., Mukhopadhyay, S.K., Saha, A.K. and Nirmal Kumar, S. (2014). Field efficacy of thiamethoxam for the management of whitefly. **Abs-80**. p.148.
9. Santha Kumar, M.V., Patnaik, M., Lalitha, N., Das, D., Saha, A.K. and Nirmal Kumar, S. (2014). Predatory potential of *Scymnus pallidicollis* (Mulsant), a biological control agent of pink mealy bug, *Maconellicoccus hirsutus* (Green). **Abs-78**. p.146.
10. Suresh Kumar, N., Saha, A. K. and Nirmal Kumar, S. (2014). Selection of breeding resource materials for the development of season and region specific bivoltine breeds of the silkworm, *Bombyx mori* L. **Abs-77**. p.145.
11. Verma, A.K., Chattopadhyay, G. K., Nirmal Kumar, S. and Saha, A.K. (2014). Comparison among Isozyme possessor native proteins in haemolymph of tropical strains/breed of multivoltine, Bi-diapausing and developed congenic breeds of silkworm, *Bombyx mori* L. **Abs-76**. p.144.

### **C. DBT Brainstorming session on mulberry held at CSR&TI, Mysore on 31<sup>st</sup> October, 2014.**

1. Banerjee, R. (2014). *Biotic stress constraints in mulberry: present status*.

### **19. CONSULTANCY & OTHER SERVICES RENDERED: NIL**

### **20. KEY SCIENTIFIC RECOMMENDATIONS MADE BY THE RAC AND RRACS**

Place	RAC	RC	EOM	RRAC
CSR&TI, Berhampore	12/09/2014 & 22/01/2015	06.05.14& 07.05.14 15.11.14 & 17.11.15	18.11.14 &19.11.14	-



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RSRS, Kalimpong	-	---	04.07.14	02.08.14 & 23.12.14
RSRS, Koraput	-	---	19-20.6.14	18.08.14& 12.12.14
RSRS, Jorhat	-	---	05.06.14	06.08.14& 06.01.15
RSRS, Ranchi	-	---	28.06.14	30.07.14& 16.12.14

### **Major Recommendations:**

#### **A. Research Advisory Committee:**

##### **1. 40<sup>th</sup> meeting held on 12<sup>th</sup> Sept., 2014**

- Priority should be given on need-based quality improvement adaptive research projects / programmes with necessary cooperation and tie-up with Director / Commissioner, DoT (Seri)/ DoSs.
- To concentrate on development of mulberry variety, package of practices and expansion of plantations in acidic soils, especially for Odisha.
- Emphasis on use of organic fertilizer by reducing inorganic fertilizer use.
- Stakeholders may be sensitized for adoption of the relevant technologies on pest and diseases management.
- Efforts should be made on integrated farming systems for expansion of mulberry acreage.

##### **2. 41<sup>st</sup> meeting held on 22<sup>nd</sup> Jan., 2015**

- For better improvement of sericultural farmers and the industry, collaborative studies with the leading Institutes may be taken up.
- Emphasize to be given for undertaking the basic research, besides the applied research.
- More emphasis to be put on the use of vermicompost and reducing the burden of insect pests and nematodes in mulberry garden.
- More emphasis to be given in dissemination of the technologies to the field.
- Identification of good bivoltine silkworm hybrids should be scrutinized for West Bengal climatic condition.
- To document and highlight the techno-economic assessment and impact of the technologies.

#### **B. Research Council:**

##### **1. 40<sup>th</sup> meeting held on 6<sup>th</sup> & 7<sup>th</sup> May, 2014.**

- Scientists of main Institute and RSRSs to take need based projects/ prog. within the available resources.
- Emphasis on research particularly on the aspect of Environment Challenges & Global warming, Input cost reduction, Labour reduction through mechanization, Eco-friendly & organic farming, drudgery reduction and women friendly technologies.
- RSRSs' should execution the research projects/ prog. within their available resources.
- To explore possibilities to popularize Nitrofert and Phosphofert biofertilizers.

##### **2. 41<sup>st</sup> meeting held on 15<sup>th</sup> & 17<sup>th</sup> Nov., 2014.**

- Gap between the technologies developed and percolated among the farming community should be bridged.



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- The breeders collect breeds from CSR&TI, Mysore and others Institute for development of breeds/hybrids.
- To impact training for the farmers on chawki rearing

### **C. Regional Research Advisory Committee (RRAC):**

#### **A. RSRS, KALIMPONG:**

##### **1. Meeting held on 2<sup>nd</sup> Aug., 2014.**

- Analyze the impact of technologies being disseminated to the field.
- Analyze the constraints faced by the farmers for technology adoption and strategies taken thereon to address the situations on percolation of technologies at the farmers' level.
- Popularization of Drum kit drip irrigation systems developed by the Institute for irrigation of mulberry field for judicious use of water during dry season.
- Popularize of pruning machine © lawn mower developed by the Institute to save time and manpower.
- Popularization of mass disinfection of rearing house using mobile disinfection equipment developed by the Institute for saving time and crop loss.
- Maintenance of District-wise and block-wise farmers' profile.
- Matching of pruning schedule for Darjeeling hills with the new crop schedule for production of quality leaves in consultation with DoT (Seri), West Bengal.

##### **2. Meeting held on 24<sup>th</sup> Dec., 2014.**

- Submission of a new programme on Muga Seed Multiplication for continuance of the programme.
- To conduct a comparative study on impact of press mud and FYM with 0.5 acre at RSRS, Farm.

#### **B. RSRS, KORAPUT:**

##### **1. Meeting held on 18<sup>th</sup> Aug., 2014.**

- To identify the problems of sericulture farmers and formulate need based projects.
- ToT should be carried out in coordination with field functionaries of the DoS, Odisha for effective implementations of technologies.
- Critical yield gaps may be identified for further studies.
- Success stories may be identified for mobilizing the farmers.
- For project "High Bush and Tree Type Mulberry Plantation under rainfed condition of Odisha", suggested to maintain plantation spacing of 5'×5', 6'×6' and 8'×8' instead of 3'×3'.

##### **2. Meeting held on 12<sup>th</sup> Dec., 2014**

- To work out economics of foliar application of sulphur with the available data/information.
- To certify chawki larvae before distribution to the farmers.

#### **C. RSRS, JORHAT:**

##### **1. Meeting held on 6<sup>th</sup> Aug., 2014**

- To collect information from the beneficiaries/ SHGs about the quality of the yarn, output, length, denier and also feedback of reeling machines to Borholla in Jorhat and Sawguri in Golaghat districts.
- To collect feedback on training from the reelers and beneficiaries.



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- To install data loggers at the place of study area to correlate weather data with the incidence of pests/ diseases along with meteorological data.

### **2. Meeting held on 6<sup>th</sup> Jan., 2015**

- To develop a seed zone at Darrang and Udalguri areas for N.E. region for self sustainable and to minimize seed procurement from NSSO, Bangalore.
- To prepare a complete “Farmers Directory” of N.E. region as database covering all the farmers of the region.
- To prepare a need-based research project for improvement of host plant and silkworm hybrid in Manipur.
- To take up a breeding programme by utilizing local breed/ race, LEIMAREL crossing with other improved bivoltine breeds.

### **D. RSRS, RANCHI:**

#### **1. Meeting held on 30<sup>th</sup> July, 2014**

- Adoption of wider spacing @ 10' x 10' in mulberry for intercropping of suitable crops and additional income by the farmers.
- To study the impact of technologies being disseminated to the field. Adoption of foliar spray of KCl for improvement of leaf quality under rainfed condition at farmers' level.
- Maintain the district-wise, block-wise sericulture farmers list along with details of CDP supports provided to the farmers.
- Increase of DFLs intake per acre by the farmers.

#### **2. Meeting held on 16<sup>th</sup> December, 2014**

- Re-orientation of Research programme in respect of "Mulberry" & "Silkworm".
- To develop an appropriate inter-cropping system with mulberry in the area collaboration with K.V.K.
- To popularize the useful technology for farmers fulfilling the objective.

### **C. EXTENSION OFFICERS' MEETING:**

#### **1. MAIN INSTITUTE :**

##### **Meeting held on 18<sup>th</sup> & 19<sup>th</sup> November, 2014.**

- Rearing reports should be incorporated in details with number of farmers and number of dfls /farmers.
- More stress and serious attention is to be given to augment the income generation exploiting the all available resources.
- Cost of production of 1 kg cocoon is to be worked out in Multi x Bi and Bi x Bi and to be submitted with the crop report.
- Emphasis should be given to work in close co-ordination with concerned DoT/Dos.



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### **2. RSRS, KALIMPONG :**

**Meeting held on 4<sup>th</sup> July, 2014.**

- To prepare Farmers Directory in assistance with DoT (Seri), W.B.
- Regular visit of chawki rearing centre and farmers' house during rearing time.
- Required breeds to be maintained at Germplasm.

### **3. RSRS, JORHAT:**

**Meeting held on 5<sup>th</sup> June, 2014.**

- Wage compensation regarding training programme for farmers is to be credited to the Beneficiaries bank account.
- Farmers Directory and technologies related to the region to be published with the assistance of DoS, Assam.
- Frequency of the visit to the RECs is to be increased.

### **4. RSRS, RANCHI:**

**Meeting held 28<sup>th</sup> June, 2014.**

- To prepare Farmers Directory in assistance with DoS, Jharkhand.
- REC (SU) Bhandra may be worked as seed multiplication center for C1730.
- Sending of crop performance report with quantum of Dfls and range of yield. Justification report to be sent if crop failure occurs.

### **5. RSRS, KORAPUT**

**Meeting held on 19-20<sup>th</sup> June, 2014.**

- To prepare a project pertaining to utilization of MGNREGA for maintenance of plantation including rain water harvest.
- Initiate the establishment of Drum KIT technology.
- IVLP cluster not to be intermingled with BV clusters. Benchmark survey to be taken up.
- Technology with foliar spray of KCL should be taken up.



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### 21. RESHAM KRISHI MELA, WORKSHOP, SEMINER, FARMERS DAY:

#### 21. A. MAIN INSTITUTE

A. TWO RESHAM KRISHI MELAS WERE ORGANIZED BY CSR&TI, BERHAMPORE AT KARIMPUR, NADIA AND BERHAMPORE, MURSHIDABAD.

#### Resham Krishi Mela

**Date:** 29.01.2015

**Venue:** DoT (Seri) farm,  
Nadia, West

A total of 322 from different parts of the Nadia attended the Mela program a grand success.

**Date :** 03.03.2015

**Venue :** CSR&TI,

A total of 1236 stakeholders/ beneficiaries/ farmers/ reelers participated from attaching districts and states in the Mela and made the program a grand success.



Karimpur,  
Bengal  
participants  
districts of  
and made the

Berhampore

#### WORKSHOP :

**Date :** 29.12.2014

**Venue :** Malda

A state level workshop was organized at Malda Directorate of Textiles (Sericulture), Govt. of West Central Silk Board on 29.12.2014 for promotion of sericulture. The workshop was inaugurated by Shri Narayan Chowdhuri, Hon'ble minister of Horticulture processing, Govt. of West Bengal presided over by Dwivedi, IAS, Magistrate, Malda, participants



their views for bivoltine sericulture in this region. A total of 48 archeivers were falcitated for their significant contribution.



jointly by the  
Bengal and  
bivoltine  
Krishnendu  
and food  
Shri S.K.  
District  
A total of 350  
exchange  
promotion of

#### B. REGIONAL SERICULTURAL RESEARCH STATION :

**Date :** 23.12.2014

**Venue :** RSRS, Kalimpong

The Mela was inaugurated by Prof. B. N. North Bengal University, Siliguri and Chairman, Nirmal Kumar, Director, CSR&TI, Berhampore the function. ISO 9001: 2008 certificate was unveiled



Chakraborty,  
RRAC. Dr. S.  
presided over  
by the



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Director. A total of 160 beneficiaries from Kalimpong and Sikkim hills participated in the Resham Krishi Mela.

**Date** : 12.12.2014

**Venue** : RSRS, Koraput

The District collector Koraput Ms. Sarangi, IAS, was the Chief S. Nirmal Kumar, Director, Berhampore was the guest total of 110 farmers from the states of Odisha Chhattisgarh.



Magistrate- Yamini Guest and Dr. CSR&TI, of Honour. A participated and

**Date** : 08.01.2015

**Venue** : RSRS, Jorhat



Shri M. P. Singh, IAS, SDO (Civil), Majuli was the chief guest. Dr. S. K. Saikia, Principal, Majuli College participated as guest of honour and Dr. D. P. Khanikar, Prof. & Head, Dept. of Sericulture, Assam Agricultural University, Jorhat and Dr. K. Giridhar, Director, CMER&TI, Lahdoigarh, Jorhat

as special guest. About 305 stakeholders participated in the mela.

**Date** : 17.12.2014

**Venue** : State Sericulture Office, Ranchi  
Shri Rajeev Ranjan, IAS, Dy. Lohardaga inaugurated the function. Dr. Kumar, Director, CSRTI, Berhampore the occasion. About 120 sericulture Ranchi, Gumla and Loharaga participated



Commissioner, S. Nirmal presided over farmers from in the event.



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### **राजभाषा अनुभाग की उपलब्धियाँ (वर्ष 2014- 2015)**

केन्द्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, बहरमपुर (प.बं.) में वर्ष 2014-15 के दौरान संघ की राजभाषा नीति का सम्यक अनुपालन किया गया। राजभाषा अधिनियम की धारा -3(3) एवं राजभाषा नियम-5 जैसे अनिवार्य प्रावधानों का शत-प्रतिशत अनुपालन सुनिश्चित किया गया है। राजभाषा हिन्दी के अन्य महत्वपूर्ण कार्यान्वयन बिन्दुओं /प्रावधानों पर भी कार्रवाई की गई। संस्थान में राजभाषा कार्यान्वयन समिति की बैठक का आयोजन कर राजभाषा प्रगति /कमियों की समय-समय पर समीक्षा, हिन्दी कार्यशाला का आयोजन हिन्दी पखवाड़ा /दिवस का आयोजन, हिन्दी भाषा प्रशिक्षण, हिन्दी पुस्तक/पुस्तिकाओं का संपादन, हिन्दी प्रतियोगिता का आयोजन एवं प्रोत्साहन योजनाओं का कार्यान्वयन किया गया। फलस्वरूप, वर्ष 2013-14 के दौरान राजभाषा नीति के कार्यान्वयन में उत्कृष्ट योगदान के लिए दिनांक 18 फरवरी, 2015 को “भारत के पूर्वी तथा पूर्वोत्तर राज्यों” के लिए कोलकाता में आयोजित क्षेत्रीय राजभाषा सम्मेलन के दौरान महामहिम राज्यपाल श्री के. सी. नाथ त्रिपाठी, पश्चिम बंगाल सरकार के कर कमलों द्वारा राजभाषा चलशील्ड से सम्मानित होने का सुअवसर इस संस्थान को प्राप्त हुआ।

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

#### **1. धारा-3(3) का अनुपालन:**

राजभाषा अधिनियम की धारा-3(3) के अन्तर्गत आने वाले सभी कागजात यथा सामान्य आदेश, निविदा, नियम, सूचना, अधिसूचना एवं संविदा करार विज्ञप्ति तथा प्रशासनिक एवं अन्य रिपोर्ट आदि अनिवार्य रूप से द्विभाषी में जारी किए गए।

#### **2. हिन्दी पत्राचार:**

वर्ष के दौरान 'क', 'ख' एवं 'ग' क्षेत्र में स्थित केन्द्र/राज्य सरकार को क्रमशः 90.30%, 85.71% तथा 'ग' क्षेत्र में स्थित केन्द्रीय सरकार के कार्यालयों को 79.58% पत्र हिन्दी में भेजे गए। इस प्रकार पत्राचार के मद में निर्धारित लक्ष्य से अधिक पत्राचार किया गया।

#### **3. हिन्दी प्रशिक्षण :**

आलोच्य अवधि के दौरान अधिकारियों/कर्मचारियों को हिन्दी शिक्षण के योजना के अधीन प्रशिक्षण कार्य जारी है। इस दौरान संस्थान के कुल 06 पदधारी हिंदी परीक्षा में उत्तीर्ण हुए हैं। अब तक संस्थान के कुल 90.97% अधिकारी/कर्मचारी इस योजना के अन्तर्गत प्रशिक्षित हो चुके हैं तथा वर्तमान सत्र (जुलाई 2014 - मई, 2015) के दौरान 05 पदधारी उक्त योजना के अधीन विभिन्न पाठ्यक्रम के अंतर्गत प्रशिक्षणाधीन हैं।

#### **4. राजभाषा कार्यान्वयन समिति की बैठक का आयोजन**

राजभाषा नियम/अधिनियम के प्रावधानों के सम्यक अनुपालन एवं समय-समय पर राजभाषा कार्यों की प्रगति /कमियों की समीक्षा हेतु संस्थान में प्रत्येक तिमाही के दौरान विभागीय राजभाषा कार्यान्वयनसमिति की बैठकों का आयोजन कर कार्यान्वयन की दिशा में आने वाली कठिनाइयों का निदान



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किया जाता है। वर्तमान वर्ष 2014-15 के अंतर्गत राजभाषा कार्यान्वयन समिति की चार बैठकों का नियमित आयोजन क्रमशः दिनांक 30/06/2014, 29/08/2014, 31/12/2014 एवं 25/02/2015 को किया गया तथा बैठक में लिए गए निर्णयों पर अनुवर्ती कारवाई की गई।

### **5. हिन्दी कार्यशाला का आयोजन:**

संस्थान में कार्यरत अधिकारियों/कर्मचारियों को हिन्दी में कामकाज करने में सुगमता हेतु प्रत्येक वर्ष हिन्दी कार्यशाला का आयोजन किया जाता है। कार्यशाला का आयोजन कर्मचारियों की कार्य प्रकृति के अनुसार अलग-अलग समूहों में किया जाता है। तकनीकी तथा प्रशासनिक संवर्ग के अधिकारियों के लिए राजभाषा के विविध पहलुओं पर क्रमशः, 13.06.2014, 26.08.2014 तथा 02.01.2015 को हिंदी कार्यशाला आयोजित कर संस्थान के कुल 51 पदधारीगण राजभाषा हिन्दी में प्रशिक्षित किए गए तथा आगे भी यह क्रम जारी है।

### **6. अधीनस्थ कार्यालयों / केन्द्रीय रेशम बोर्ड के अन्य कार्यालयों आंबटित कार्यालयों में हिन्दी कार्यशाला**

संस्थान की संबद्ध इकाइयों में भी संघ की राजभाषा नीति के सफल कार्यान्वयन हेतु हिन्दी कार्यशालाओं का आयोजन किया जाता है। इस क्रम में क्षेत्रीय रेशम उत्पादन अनुसंधान केन्द्र, कलिम्पोंग, रांची, जोरहाट एवं कोरापुट तथा अनुसंधान प्रसार केन्द्र, महेशपुर राज, मोथाबाड़ी, इम्फाल, शिलांग, दीमापुर, कामनगर के अतिरिक्त क्षेत्रीय कार्यालय, कोलकाता में भी पूर्ण दिवसीय हिन्दी कार्यशालाओं का आयोजन किया गया।

### **7. राजभाषा प्रोत्साहन योजना का कार्यान्वयन:**

संस्थान एवं इसके संबद्ध/अधीनस्थ केन्द्रों में कार्यरत अधिकारियों तथा कर्मचारियों में राजभाषा हिन्दी के प्रति अभिरुचि जगाने हेतु समय-समय पर विभिन्न राजभाषा कार्यक्रम/प्रतियोगिता का आयोजन किया जाता है। इन कार्यक्रमों द्वारा कर्मचारियों को प्रोत्साहित/पुरस्कृत करने के अलावा हिन्दी में मूल रूप से टिप्पण-आलेखन करने वाले अधिकारियों/कर्मचारियों के लिए केन्द्रीय रेशम बोर्ड की उदारीकृत प्रोत्साहन योजना को भी लागू किया गया है जिसके अन्तर्गत निर्धारित शब्द संख्या हिन्दी में लिखने पर अनुपाततः नगद प्रोत्साहन राशि (महत्तम रू 2000.00) प्रदान की जाती है। हिन्दी दिवस/पखवाड़ा, 2014 के अवसर पर वर्ष 2013-14 के दौरान मूल रूप से हिन्दी में कामकाज करने हेतु कुल 10 पदधारियों को पुरस्कृत किया गया।

### **8. हिन्दी पुस्तक/ पुस्तिकाओं का प्रकाशन:**

संघ की राजभाषा नीति के अनुसार संस्थान में अंग्रेजी प्रकाशनों के अनुरूप वैज्ञानिक एवं तकनीकी/प्रशासनिक प्रकाशनों का हिन्दी रूपांतरण तथा मूल रूप से हिंदी में लिखित पुस्तकें आवश्यकतानुसार प्रकाशित की जाती हैं। वर्तमान वर्ष के अंतर्गत संस्थान की वार्षिक वैज्ञानिक एवं प्रशासनिक रिपोर्ट वर्ष 2013-14 का सारांश हिंदी में प्रकाशित करने के अतिरिक्त आलोच्य अवधि के दौरान रेशम कृषि मेला के अवसर पर “शहतूत कृषि निर्देशिका” शीर्षक से एक पुस्तिका बंगला भाषा में प्रकाशित की गई।



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### **9. नगर राजभाषा कार्यान्वयन समिति का गठन एवं उसकी बैठकों का आयोजन**

वर्ष 1997-98 के शुरुआत में ही राजभाषा विभाग, भारत सरकार, नई दिल्ली द्वारा संस्थान के निदेशक को अध्यक्ष के रूप में नगर राजभाषा कार्यान्वयन समिति के गठन, बैठकों के नियमित आयोजन तथा बहरमपुर नगर स्थित केन्द्रीय सरकार के कार्यालयों /बैंकों/निगमों/उपक्रमों/संगठनों आदि में संघ की राजभाषा नीति के सफल कार्यान्वयन का अतिरिक्त दायित्व निहित किया गया। समिति के प्रयास से नगर स्थित केन्द्रीय सरकार के कार्यालयों /बैंकों/निगमों/उपक्रमों/संगठनों आदि में भी राजभाषा गतिविधियां बढ़ी हैं। इसके अतिरिक्त, नगर के सदस्य कार्यालय अपने-अपने कार्यालयों में हिन्दी दिवस, प्रतियोगिता, संगोष्ठी कार्यशाला एवं बैठकों का आयोजन कर रहे हैं। समिति की उक्त गतिविधियों के संचालन से संस्थान में राजभाषा कार्यान्वयन संबंधी कार्यमात्रा में भी अत्याधिक वृद्धि हुई है।

### **10. राजभाषा नियम 10(4) के अन्तर्गत अधीनस्थ कार्यालयों को अधिसूचित किया जाना**

संस्थान के सम्बद्ध/अधीनस्थ केन्द्रों में कार्यरत 80% कर्मचारियों को हिन्दी प्रशिक्षण दिलाने के पश्चात ऐसे कार्यालयों को मंत्रालय द्वारा राजभाषा नियम -10(4) के अधीन अधिसूचित करने की कार्यवाही की जाती है। इस क्रम में संस्थान के 13 संबद्ध कार्यालयों को अधिसूचित कराया जा चुका है।

### **11. हिन्दी प्रतियोगिता का आयोजन:**

वर्ष 2014-15 के दौरान दिनांक 01.09.14 से 25.09.14 तक आयोजित हिन्दी पखवाड़ा के अन्तर्गत विभिन्न हिन्दी प्रतियोगिता का आयोजन किया गया। इन प्रतियोगिता में संस्थान के अधिकारियों/ कर्मचारियों ने उत्साह से भाग लिया। इस दौरान कुल 08 हिन्दी प्रतियोगिताओं क्रमशः हिंदी टिप्पण व आलेखन 01/09/14, शब्दावली 02/09/14, निबन्ध 03/09/14, वाद विवाद 04/09/14, सुलेख व श्रुतलेख 05/09/14, राजभाषा प्रश्नोत्तरी 08/09/14, अंत्याक्षरी 09/09/14, तात्क्षणिक भाषण 10/09/14 का आयोजन किया गया। प्रत्येक प्रतियोगिता के सर्वश्रेष्ठ प्रतिभागियों को प्रथम, द्वितीय, तृतीय एवं सांत्वना पुरस्कार से पुरस्कृत किए गए।

### **12. कम्प्यूटर पर हिन्दी में कार्य:**

राजभाषा अधिनियम -1963 की धारा 3(3) का अनुपालन, फार्म/प्रपत्र का द्विभाषीकरण, सम्बद्ध/अधीनस्थ केन्द्रों की तिमाही रिपोर्ट का समेकीकरण एवं अनुभागीय प्रगति रिपोर्ट के तुलनात्मक विवरण आदि के संकलन एवं पत्रिका के प्रकाशन/संपादन का कार्य तथा नगर राजभाषा कार्यान्वयन समिति की गतिविधियों संबंधी कार्य को कम्प्यूटर पर सुचारू रूप से किया जा रहा है। राजभाषा कार्यान्वयन के विभिन्न पहलुओं में कम्प्यूटर के प्रयोग की शुरुआत से राजभाषा कार्यान्वयन के कार्य में गति आई है साथ ही साथ संस्थान की राजभाषा कार्यान्वयन समिति की बैठकों में हिन्दी प्रगति से संबंधित आंकड़ों का प्रस्तुतीकरण पावर-प्वाइंट के जरिये किया जा रहा है। ज्ञातव्य है कि संस्थान में बहुभाषी पैकेज “यूनिकोड” तथा “माइक्रोसॉफ्ट इंडिक लैंग्वेज इनपुट टूल्स ” का संस्थापन कम्प्यूटर पर किया गया है जिससे शब्द प्रक्रमण के अलावा आंकड़ों के प्रक्रमण, आरेखीय निरूपण, आंकड़ों के समेकीकरण में सहूलियत एवं गति आई है।



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### 23. IMPLEMENTATION OF RIGHT TO INFORMATION ACT (RTI, 2005)

Sl. No.	Applicant and address	Date of Request	Details of compliance/ rejection of request		Relevant RTI section, if request rejected	Amount of Charges <sup>1</sup> collected (in Rs.)
			Office order No.	Date		
1	Ramesan A. VIPPS Centre, 2 LSC Block-EFGH, Masjid Moth, GK-II, New Delhi- 110048	01.12. 2014	CSB/ CSRTI/ PMCE/2014 -15/ 2335/ 14980	17.12 .2014	-	10/-
2	Ramesan A. VIPPS Centre, 2 LSC Block-EFGH, Masjid Moth, GK-II, New Delhi- 110048	20.12. 2014	CSB/ CSRTI/ PMCE/2014 -15/ 2485/ 16602	30.12 .2014	-	36/-
3	Ramesan A. VIPPS Centre, 2 LSC Block-EFGH, Masjid Moth, GK-II, New Delhi-110048	20.12.2014	CSB/ CSRTI/ PMCE/ R-38/ 2014-15/ 2836/ 17731	17.01 .2015	-	10/-

### 24. DISTINGUISHED VISITORS:

Sl. No.	Name	Designation	Date
1.	Colonel Anil Pandit	Director, Army Recruiting Office, Berhampore	24.05.2014
2.	Shri Y.R.Rao, IAS	District Magistrate, Murshidabad	21.07.2014
3.	Smt. Soma Bhattacharyee, IAS	Commissioner of Textiles (Seri.) Govt. of West Bengal	21.08.2014
4.	Smt. Ishita Roy, IAS,	Member Secretary, CSB, Bangalore	12.09.2014
5.	Shri Swapan Chandra Pal	Director General, Bangladesh Sericulture Development Board, Rajshahi, Bangladesh	29.11.2014
6.	Smt. Keiko Kadono Okuda	Scientist, National Institute of Aeobiological Sciences, Tsukuba, Japan	19.02.2015
7.	Shri N.S. Bisse Gowda	Chairman, Central Silk Board, Bangalore	03.03.2015
8.	Shri S. Satish Kumar	Director (Finance), Central Silk Board, Bangalore	03.03.2015



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Shri Y. R. Rao, DM, MSD visited this Institute on 21.07.2014.



Smt. Soma Bhattacharya, IAS, Commissioner of Textile, Govt. of West Bengal visited this Institute on 21.07.2014.

Smt. Ishita Roy, IAS, MemberSecretary, CSB, Bangalore visited on 12.09.2015



A team of Bangladesh Sericulture Development Board (BSDB), Rajshahi, Bangladesh visited on 29.11.2015



Shri N. S. Bisse Gowda, Honorable Chairman, Central Silk Board, Bangalore visited RSRS, Kalimpong on 7<sup>th</sup> Dec., 2014 and the Institute on 03.03.2015.



Shri Bimal Gurung, Chairman, GTA, visited Krishi Mela organized by Gorkha Territorial Administration (GTA) held at Kalimpong, Darjeeling from 15.01.2015 to 17.01.2015.



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### 25. LIST OF MEMBERS RESEARCH ADVISORY COMMITTEE, RRACs:

<p><b>Chairman</b> Dr. Saroj Kumar Sanyal, Ex- Vice-Chancellor, Saptaparni ,Flat A1 (Ground Floor), 58/3, Ballygunge Circular Road, <b>Kolkata-700 019, West Bengal</b></p>	
<p><b>Members, RAC</b></p>	
1.	<p>Prof. Kanchan Baral, Dept. of Plant Protection, Palli Siksha Bhavan, <b>Sriniketan – 723 326,</b> Dist. Birbhum, West Bengal</p>
11.	<p>Director <b>Member, RAC</b> CSTRI, Central Silk Board, P.O. Madiwala, BTM Layout, <b>Bangalore – 560 068</b></p>
2.	<p>Prof. Sunirmal Maity, Department of Agronomy B-2/221, <b>P.O. Kalyani-741 235</b> Dist- Nadia, West Bengal</p>
12.	<p>Shri Prafulla Kumar Mondal Reelers Representative (RAC) Vill +P.O.- Madhughat PS.- Kaliachak, Dist.- Malda</p>
3.	<p>Dr. Rajeev Kumar Varshney, Director, Centre of Excellence in Genomics (CEG), Applied Genomics Laboratory, <b>Patancheru – 502 324, Andhra Pradesh</b></p>
13.	<p>Md. Sufian Ali Rearers Representative (RAC) S/o- Sher Mahammad Vill +P.O.- Alinagar PS.- Kaliachak, Dist.- Malda</p>
4.	<p>Dr. S. Senthil Vinayagam, Director, National Institute of Agricultural Extension Management, Rajendranagar, <b>Hyderabad-500030, Andhra Pradesh</b></p>
14.	<p>Director of Textiles, Govt. of West Bengal, 45, Ganesh Chandra Avenue <b>Kolkata, West Bengal</b></p>
5.	<p>Dr. M. V. Samson, Former Director (CSB), 13, Parama Street, <b>Nagercoil- 629001,</b> K.K.District,Tamil Nadu</p>
15.	<p>Director of Textiles &amp; Handloom Govt. of Orissa, Sahidnagar, <b>Bhubaneswar - 751 007, Odisha</b></p>
6.	<p>Dr. B. S. Angadi, Director (Tech.), Central Silk Board, P.O. Madiwala, BTM Layout, <b>Bangalore – 560 068</b></p>
16.	<p>Director of Sericulture, Govt. of Chhattisgarh, Resham Sanchanalaya Kanj Bhawan, Ring Rd, Telibandh <b>Raipur- 492 06, Chhattisgarh</b></p>
7.	<p>Director (NSSO), Central Silk Board, P.O. Madiwala, BTM Layout, <b>Bangalore – 560 068</b></p>
17.	<p>Director (Hand &amp; Seri.), Deptt. of Industries, Govt. of Bihar, Vikas Sachivalaya, <b>Patna- 800 015, Bihar</b></p>
8.	<p>Director, CSR&amp;TI, <b>Berhampore – 742 101</b> Murshidabad, West Bengal</p>
18.	<p>Director of Sericulture, Govt. of Mizoram, Aizawl – 796 001, Mizoram</p>
9.	<p>Director (I/c), CSTRI, Central Silk Board, P.O. Madiwala, BTM Layout, <b>Bangalore – 560 068</b></p>
19.	<p>Director of Industries, Govt. of Jharkhand, III Floor, Nepal House, Doranda, Ranchi - 834 002, Jharkhand</p>
10.	<p>Director Dos, Arunachal Pradesh</p>
20.	<p>Director of Sericulture, Govt. of Nagaland, <b>Kohima – 797 001, Nagaland</b></p>



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21	Director of Handlooms, Handicrafts & Sericulture, Govt. of Tripura, Pandit Jawaharlal Nehru Complex, Gorkha Basti, <b>Agartala – 799 006</b> , Tripura	28.	Deputy Secretary (Tech.), Regional Development Office, Central Silk Board, 18, Satyanagar, P.O. Sahidnagar, <b>Bhubaneswar – 751 007</b> , Orissa
22.	Director of Sericulture & Weaving Govt. of Meghalaya, 3 <sup>rd</sup> Sectt. (Nongkrek building), 2 <sup>nd</sup> Phase, 2 <sup>nd</sup> Floor, Lower Iachumiere, <b>Shillong – 793 001</b> , Meghalaya	29.	Assistant Secretary (Tech.) Regional Office, Central Silk Board, Near Handloom Bhavan, Ist Floor, Patliputra Path Rajendra Nagar <b>Patna – 800 016</b> , Bihar
23	Addl. Director of Sericulture, Deptt. of Forest & Environment, Govt. of Sikkim, Deorali, Gangtok, <b>Sikkim</b>	30.	The Scientist-D, Regional Sericultural Research Station Central Silk Board, 7th Mile, Reshambari, <b>Kalimpong -734 301</b> .
24.	Director of Sericulture, Govt. of Manipur, P.O. Lamphelpat, <b>Imphal-795004</b> , Manipur	31.	The Scientist-D Regional Sericultural Research Station Central Silk Board, Piska Nagri, <b>Ranchi-835 303</b> , Jharkhand.
25.	Director of Sericulture, Govt. of Assam (Near Research Gate), P.O. Khanapara, <b>Guwahati-781 022</b> , Assam	32.	The Scientist-D(I/c) Regional Sericultural Research Station Central Silk Board <b>Koraput -764 020</b> , Odisha
26.	Joint Secretary (Tech.) Regional Office, Central Silk Board, 1 <sup>st</sup> floor, 15, Dhakuria, Ghariahat Road (South), <b>Kolkata - 700 031</b> .	33.	The Scientist-D, Regional Sericultural Research Station Central Silk Board, Rawriah, Jamuguri <b>Jorhat -785 005</b>
27	Joint Secretary (Tech.) Regional Office, Central Silk Board, Banphool Nagar Path (Near Wireless), Basistha Road, P.O. Dispur, <b>Gwahati - 781 005</b> , Assam		



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### B. REGIONAL RESEARCH ADVISORY COMMITTEE

#### RSRS, KALIMPONG, WEST BENGAL

Sl. No	Name	Position
1.	Prof. B. N. Chakraborty, Dept. of Botany, NBU, Siliguri, WB.	Chairman
2.	Director, CSR&TI, Berhampore , WB.	Vice- Chairman
3.	Dr. P. K. Mukherjee, Dept.of Agronomy,UBKV,Coochbehar, WB.	Convener
4.	Dr. P.K. Pal, Dept. of Extn. Education, UBKV, Cooch Behar, WB.	Member
5.	Prof. A. Mukhopadhyaya, Zoology Dept., NBU, Siliguri, WB.	Member
6.	Shri R. Bhattacharya, Jt. Secretary (Tech), R. O, CSB, Kolkata, WB.	Member
7.	Shri H. P. Rai, Addl. Director, DoS, Sikkim.	Member
8.	Addl. Director, DoT (Seri), West Bengal.	Member
9.	Smt. Ongmu Sherpa, Farmer, Mahakaldara, Kalimpong, WB.	Member
10.	Shri Rafiq Ali, Reeler, Malda, WB.	Member
11.	Dr. K. Sathyanarayana, Scientist-D, CSB, Bangalore	Member
12.	Smt. C. Maji, Scientist-D, RSRS, Kalimpong, WB.	Member Convener

#### RSRS, KORAPUT, ODISHA

Sl. No.	Name	Position
1	Dr. M. Madhu, Head, Central Soil and Water Conservation Research & Trg. Institution, ICAR, Sunabeda, Koraput, Odisha.	Chairman
2	Director, CSR&TI, Central Silk Board, Berhampore, West Bengal	Vice-Chairman
3	Smt. Pravamayee Acharjya, Extension Scientist, Project Co-ordinater, Govt. of Odisha, Semiliguda, Koraput	Member
4	Dr. P.P. Adhikary, Soil Scientist (Agronomy), Central Soil and Water Conservation Research & Training Institution, ICAR, Sunabeda, Koraput,	Member
5	Dr. Karan Chanda Hembram, Higher Altitude Research Station. Pottangi, Koraput, Odisha.	Member
6	Shri G.C.Roy, Deputy Secretary (Tech), Regional Office, CSB, Bhubaneswar.	Member
7	Shri Bijoy Kumar Misra, Assistant Director of Sericulture, Govt. of Odisha, Koraput.	Member
8	Shri Binda Muduli, Majhiguda, Dasamantpur, Koraput, Odisha.	Rearer's rep.
9	Ms.Gitanjali Sahu, Silk Reeler, Mahendragarh, Gajapati, Odisha.	Reeler's rep.
10	Shri R.C.Das, Asst. Secretary (Tech.). CO., Bangalore	Member
11	Scientist-D (I/C), RSRS, Central Silk Board, Koraput, Odisha.	Member Convener,



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### RSRS, RANCHI, JHARKHAND

Sl. No.	Name	Position
1.	Dr. R.P. Singh Ratan, Director, Extension Education, Birsa Agruculture University, Kanke, Ranchi, Jharkhand.	Chairman
2.	Director, CSR&TI, Central Silk Board, Berhampore , WB.	Vice-Chairman
3.	Dr. (Mrs.) Valeria Lakra, SMS (Extension) Deputy Director (Information), Directorate of Extension Education, BAU, Kanke, Ranchi, Jharkhand	Member
4.	Dr. M. K. Singh, University Professor-cum-Chief Scientists, Dept. of Agronomy, BAU, Ranchi.	Member
5.	Dr. Sailesh Chattopadhyay, University Professor-cum Chief Scientist, Entomology, Faculty of Forest, BAU, Kanke, Ranchi, Jharkhand.	Member
6.	Jt. Director, Directorate of Handloom, Sericulture & Handicraft, Dept. of Industries, Govt. of Jharkhand, Ranchi, Jharkhand	Member
7.	Assistant Secretary (Tech), RO, CSB, Patna	Member
8.	Shri Deep Narayan Sahu, Farmer, Bisunpur, Gumla, Jharkhand.	Member
9.	Shri Bandhana Oraon, Farmer, Khashitoli, Gumla, Jharkhand.	Member
10.	Shri B.S.Prabhakar, Asstt Secretary (Tech), CSB, Bangalore	Member
11.	Scientist-D (I/C), RSRS, Central Silk Board, Ranchi, Jharkhand.	Member Convener

### RSRS, JORHAT, ASSAM

Sl. No.	Name	Position
1.	Dr. Pranab Talukdar, Sr. Professor & Head, Dept. of Breeding and Genetics, AAU, Jorhat	Chairman
2.	Director, CSR&TI, Berhampore, WB.	Member
3.	Dr. Kalyan Pathak, Sr. Scientist, AAU, Jorhat, Assam	Member
4.	Dr. Badal Bhattacharya, Sr. Scientist, Dept of Entomology, AAU, Jorhat	Member
5.	Dr. Utpal Barman, Associate Professor, Dept of Extension Education, AAU, Jorhat	Member
6.	Shri Sarat Deori, Joint Secretary (Tech), R.O., C.S.B, Guwahati, Assam.	Member
7.	Shri Moncy Issac, Deputy Secretary (Tech), CSB, C.O., Bangalore.	Member
8.	Shri Jiten Barapujari, Asstt Director of Sericulture, DoS, Jorhat, Assam	Member
9.	Shri Ranjit Doley, Baphala, Jorhat, Assam	Member
10.	Smt Anju Pegu, Baphala, Jorhat, Assam	Member
11.	Dr. S. N. Gogoi, Scientist – D, RSRS, Jorhat,	Member Convener



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### 26. SCIENTIFIC & ADMINISTRATIVE PERSONNEL OF CSR&TI AND ITS CONSTITUENT UNITS

**Dr. S. Nirmal Kumar, Director**

#### **Scientist-E (R&S):**

Shri M. K. Majumdar

Divisional head, Reeling & Spinning

#### **Scientists D:**

Dr. A. K. Saha

Divisional head, Sericulture

Dr. M. K. Ghosh

Divisional head, Moriculture

Dr. S. RoyChowdhuri

Divisional head, PMCE & Agronomy

Dr. S. K. Mukhopadhyay

Divisional head, Extension

Dr. (Mrs.) Jalaja S. Kumar

Divisional head, Training

Dr. S.K. Mandal

Divisional head, Agronomy & FM

#### **Scientists-D/C:**

##### **SERICULTURE DIVISION**

##### **Silkworm Breeding & Genetics :**

Dr. N. Suresh Kumar, Sci.-D

Dr. G.K. Chattopadhyay, Sci.-D (upto 31.10.14)

Dr. A.K.Verma, Sci.-C.

##### **Biotechnology Section:**

Dr. (Mrs.) Rita Banerjee, Sci.-D

Dr. S Chattopadhyay, Sci.-D

##### **SW Physiology & RTI :**

Dr. (Mrs.) T. Dutta (Biswas) Sci.- D (upto 13.06.14)

##### **Entomology :**

Dr. M. V. Santha Kr., Sci.-D (up to 03.01.15)

Mrs. N. Lalitha, Sci.-C

##### **Silkworm Pathology Section:**

Dr. S. Sree kumar, Sci.-D

Dr. S. Chakrabarty, Sci.-C

##### **MORICULTURE DIVISION**

##### **Mulberry Breeding & Genetics:**

Dr. P. K. Ghosh, Sci. – D (upto Oct.,14)

##### **Mulberry Pathology :**

Dr. S. K. Dutta, Sci -D

##### **Soil Science and Chemistry:**

Dr. R. Kar, Sci.-D

##### **AGRONOMY AND FM DIVISION**

##### **Agronomy :**

Dr. S. Rajaram, Sci.- D

##### **Farm Management:**

Dr. (Mrs) M. Chaudhuri, Sci-D

##### **Mulberry Physiology:**

Dr. P. K. Tewary, Sci.- D

##### **TRAINING DIVISION**

Dr. (Mrs.) Subhra Chanda, Sci-D

Shri Zakir Hossain, Sci.-C

Shri D. Chakravarty, Sci.-C (from 09.10.14)

##### **EXTENSION DIVISION**

Dr. P. K. Ghosh, Sci. – D (from Nov.,14)

Shri G.C.Das, Sci.-C

Dr. M.S. Rahaman, Sci-C(upto 30.09.14)

Dr. (Mrs.) Jayeeta Sarkar (fr.08.05.2014 to 13.10.14)

Shri Debojit Das, Sci. – C

Shri T.N.Sreekantha, AD (Stat.) (fr. 10.11. 14)

##### **PMCE DIVISION**

Dr. M. K. Singh, Sci-D (upto 31.12.14)

Dr.U.K.Bandopadhyay,Sci-D (fr. 25.05.14)

Shri D. Chakravarty, Sci.-C (upto 08.10.14)

Dr. (Mrs.) Jayeeta Sarkar (fr.14.10.14)

##### **Computer & Statistics:**

ShriN.K..Das, AD (Stat.) (upto30.06.14)

Shri P. K. Mahapatra, A D (Comp)

##### **REELING & SPINNING DIVISION**

Shri S. S. Manna, Sci. – D (upto 30.06.14)

Shri N.B.Kar, Sci. – D



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### **ADMINISTRATION**

Shri P. D. Mishra, A. D. (A & A) (upto 30.06.14)  
Shri Manas Roy, A.D. (A & A)  
Shri G.R.V. Reddy, Asst. Eng.  
Shri Biswajit Halder, A. D. (A & A) (fr. 25.08.14)

### **OFFICIAL LANGUAGE**

Shri Ram Briksh Choudhary, D.D.

### **REGIONAL SERICULTURAL RESEARCH STATION:**

**RSRS, Kalimpong (West Bengal)**  
Smt. C. Maji, Sci. - D  
Smt. Regina Bhutia, Sci.-D (upto 30.05.14)  
Shri S. Chatterjee, Sci. - D  
Dr. U. K.Bandyopadhyay, Sci. - D(upto 13.05.14)  
Dr. M. D. Maji, Sci. - C  
Shri Ram Lakhan Ram, Sci. - C

### **RSRS, Koraput (Odisha)**

Shri R. Sahu, Sci.- C  
Dr. N. R. Rao, Sci.- C  
Shri S. K. Misro, Sci.- C

### **RSRS, Jorhat (Assam)**

Dr. S. N. Gogoi, Sci. - D  
Dr. Y. Debaraj, Sci. - D  
Dr. U.C. Barua, Sci -C  
Smt. M. Pamehgam, Sci. - C

### **RSRS, Ranchi (Jharkhand)**

Dr. M. Alam, Sci.- C

### **RESEARCH EXTENSION CENTRES & SUB UNITS:**

#### **REC, Mothabari (West Bengal)**

Shri A. K. Dutta, Sci. – C; Dr. J. Sarkar, Sci.-C,  
(upto 07.05.14)

#### **REC, Kamnagar (West Bengal)**

Dr. Tapati Dutta (Biswas), Sci. - D

#### **Sub-REC, Rampuhat (West Bengal)**

Dr. (Mrs) M. Patnaik, Sci. - D

#### **REC, M.P. Raj (Jharkhand)**

Dr. D. Pandit, Sci. - D

#### **REC, Gumla (Jharkhand)**

Dr. Ram Kumar, Sci-C  
Dr. S.P. Sharma, Sci. – D

#### **Sub, REC, Bhandra (Jharkhand)**

Dr. G.S.Singh, Sci.-D

#### **Sub-REC, Rajmahal (Jharkhand)**

Technical Assistant

#### **REC, Bademarang (Chhattisgarh)**

Smt. Nilima Nag, TA

#### **REC, Deogarh (Odisha)**

Dr. D. P. Dasmahapatra, Sci. - C  
Dr. K. M. Purohit, Sci. – C (upto 31.03.15)

#### **REC, Mangaldoi, BTC, Assam**

Dr. B. K. Basumatary, Sci-C

#### **REC, Imphal (Manipur)**

Dr. L. Somen Singh, Sci. – C

#### **REC, Shillong (Meghalaya)**

Dr. Collin Z. Renthlei, Sci-C

#### **REC, Aizawl (Mizoram)**

Shri B. Chowdhury, Sci. – D  
Dr. Lalthlamuana Pachuau, Sci. - C

#### **REC, Dimapur (Nagaland)**

Dr. A. K. Bora, Sci. - D

#### **REC, Agartala (Tripura)**

Dr. G. B. Singh, Sci. - D

#### **REC, Rongpo (Sikkim)**

Shri S.T. Lepcha, Sci. - C



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### 27. SPECIAL ACTIVITIES ON WOMEN EMPOWERMENT, DEVELOPMENT OF SC/ST OR PEOPLE BELOW POVERTY LINE

The following human resource development prog. were conducted for empowerment and strengthening of the weaker section of the society.

#### 27.A. Details of SC/ST candidates who participated in various training prog.

Subject	Duration (Days)	Sex	Gen.	SC	ST	OBC	Minority	Total	Grand Total
<b>ISDS, MAIN INSTITUTE</b>									
Cocoon Reeling & spinning	15 days (4 batches)	Male	6	9	-	16	23	54	61
		Female	1	1	-	3	2	7	
Commercial Silkworm Rearing	15 (7 batches)	Male	22	43	-	28	27	120	12
		Female	1	1	-	-	2	4	
Mulberry Cultivation	15 days (3 batches)	Male	8	13	1	11	12	45	45
		Female	-	-	-	-	-	-	
<b>TOTAL =230</b>									
<b>ISDS, RSRS, JORHAT &amp; NESTED RECs</b>									
Commercial Silkworm Rearing	15 days (6 batches)	Male	-	-	13	8	-	21	10
		Female	3	37	31	12	-	83	
Mulberry Cultivation	15 days	Male	-	-	-	-	-	-	15
		Female	2	-	13	-	-	15	
<b>ISDS, RSRS, KORAPUT</b>									
Mulberry Cultivation	15 days	Male	2	-	13	-	-	15	15
		Female	-	-	-	-	-	-	
<b>ISDS, RSRS, KALIMPONG</b>									
Mulberry Cultivation	15 days	Male		9	1	-	-	13	14
		Female		-	1	-	-	1	
Commercial Silkworm Rearing	15 days	Male	1	-	1	1	-	3	13
		Female	5	-	-	3	2	10	
<b>ISDS, RSRS, RANCHI</b>									
Mulberry Cultivation (at Deogarh)	15 (2 batches)	Male	7	4	-	-	-	11	14
		Female	1	-	2	-	-	3	
<b>SKILL UPDATION PROGRAMME (FARMERS): MAIN INSTITUTE</b>									
Mulberry varieties, cultivation and vermicomposting	5 days (2 batches)	Male	2	4	9	5	9	29	37
		Female	1	1	3	3	-	8	



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Subject	Duration (Days)	Sex	Gen.	SC	ST	OBC	Minorities	Total	G. Total
Integrated disease & pest management	5 days (2 batches)	Male	2	6	14	6	8	36	43
		Female	3	1	3	-	-	7	
Chawkie silkworm rearing	10 days (2 batches)	Male	4	7	-	6	15	32	32
		Female	-	-	-	-	-	-	
<b>Beneficiary Empowerment Programme</b>									
DoS, Jharkhand	4 days	Male	-	-	27	-	-	27	50
		Female	-	-	23	-	-	23	
DoS, Odisha	4 days	Male	-	4	5	-	-	9	19
		Female	-	1	3	6	-	10	
DoS, Assam	3 days	Male	2	-	16	10	-	28	39
		Female	-	-	4	7	-	11	
<b>TOTAL= 108</b>									
Orientation Training Prog. (For In-service candidate)	5 days (2 batches)	Male	9	1	--	-	-	10	11
		Female	1	-	-	-	-	01	
Rearing Technology & Grainage Management	6 days	Male	3	1	-	1	-	05	5
		Female	-	-	-	-	-	-	
Refresher Course Training Programme	5 days (2 batches)	Male	14	1	1	-	1	17	19
		Female	1	1	-	-	-	2	
Hands-on training on Income Tax Package	3 days	Male	11	05	03	-	-	19	25
		Female	6	-	-	-	-	6	
Trainers' Training Programme	15 (3 batches)	Male	15	1	14	8	-	38	90
		Female	19	5	15	13	-	52	
Training on crop insurance	2	Male	11	-	-	-	-	11	12
		Female	1	-	-	-	-	01	
Examination of mother moth and Acid Treatment	03 days (5 batches)	Male	40	15	3	5	10	73	93
		Female	17	1	1	1	-	20	
Reeling Training under NFM (BRGF)	13	Male	1	2	-	3	19	25	29
		Female	1	-	-	2	1	4	
<b>Reeling Training under NFM (BRGF):29</b>									
Refresher Training under Seed Act to chawkie silkworm rearers.	3 days (2 batches)	Male	-	2	-	1	14	17	17
		Female	-	-	-	-	-	-	
Refresher Training under Seed Act to chawkie silkworm rearers: 17								<b>TOTAL Ad Hoc: 397</b>	
<b>GRAND TOTAL: 958</b>									

**27.B. Participated in one day National Conference on 'Empowering of Women through Sericulture' at India Habitat Centre, New Delhi on 17.09.014:** Dr. (Mrs.) Rita Banerjee, Scientist-D; Dr. Jalaja S. Kumar, Scientist – D; Mrs. N Lalitha, Scientist-C; Dr (Mrs.) T. Dutta (Biswas), Scientist-D; Dr. S. Roy Chowdhuri, Scientist- D; Dr. G.B.Singh, Scientist-D.



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### 28. VISIT OF STUDENTS FROM UNIVERSITIES/COLLEGES/SCHOOLS/ ORGANIZATIONS AND FARMERS FOR AN EXPOSURE TO MULBERRY SERICULTURE

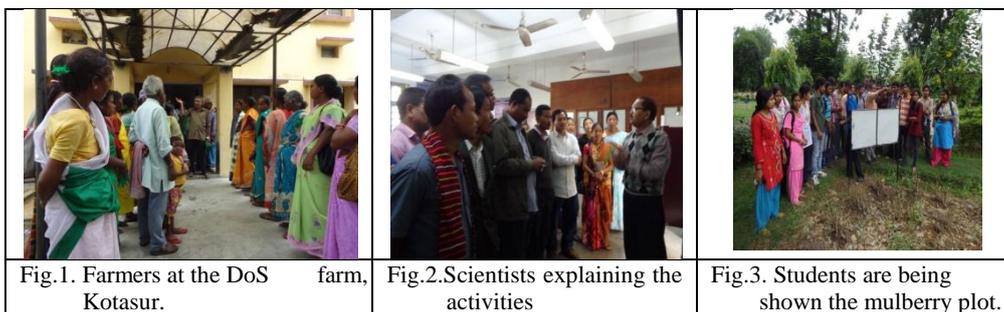
A total of 381 students, 32 nursing staff and 198 farmers along with escorts were exposed to modern technologies concerning sericulture activities during 2014-15 at this Institute.

#### VISIT OF STUDENTS

Sl. No.	Date	Sponsored by	Persons (No.)
1.	23-25.04.2014	CTR&TI, Ranchi, Jharkhand	17
2.	22.05.2014	Julian Day School, Kolkata	8
3.	28.05.2014	K.N.College, Berhampore, Murshidabad	41
4.	25.07.2014	University of Gour Banga, Malda	13
5.	21.11.2014	Tribeni Tissues Vidyapith, Chandrahati, Hooghly, W.B.	116
6.	24.11.2014	Shri Shikshayatan College, Kolkata	69
7.	15.01.2015	Jogamaya Devi College, Kolkata	88
8.	18.02.2015	Agriculture Rural Development University, Barasat, W.B.	29
<b>Total</b>			<b>381</b>

#### VISIT OF FARMERS/ EMPLOYEES

Sl. No.	Date	Sponsored by	Persons (No.)
1.	22.04.2014	Nursery Training School, Berhampore, Murshidabad	32
2.	02-05.06.2014	Gumla & Lohardaga, Jharkhand	18
3.	20.08.2014	TSC, Bethuadahari, Nadia, West Bengal	24
4.	29.08.2014	Krishanganj Block, Nadia, West Bengal	80
5.	25.09.2014	Hariharpara Block, Nadia, West Bengal	59
6.	07.01.2015	DoS, Uttar & Dakshin Dinajpur, West Bengal	17
<b>Total</b>			<b>230</b>



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### 29. METEOROLOGICAL DATA

Meteorological data on Temperature, Relative humidity & Rainfall at CSR&TI, BERHAMPORE (Latitude 24°6'N, Longitude 88°15'E, Altitude 19 M above MSL)

Month	Temperature (°C)		Relative Humidity (%)		Rain-fall (mm)	Rainy days (No)	Wind velocity (kmph)	Bright sun shine (hrs)	Evapor-ation (mm/hr)
	Max	Min	Max	Min					
April, 14	37.71	24.23	64.30	39.13	0	0	1.66	8.75	0.25
May, 14	37.71	26.0	76.45	53.81	106.0	6	4.95	7.31	0.21
June, 14	34.59	26.70	85.70	74.43	121.0	7	3.83	4.37	0.15
July, 14	32.52	27.15	90.06	82.06	213.0	21	3.77	4.0	0.13
Aug., 14	32.56	26.94	87.87	74.94	124.0	14	2.86	3.86	0.18
Sept., 14	32.63	26.37	84.57	74.67	309.0	14	2.50	5.55	0.18
Oct., 14	31.68	23.86	83.29	72.61	16.0	7	1.81	6.38	6.38
Nov., 14	29.29	16.61	72.76	59.53	2.0	1	1.48	7.10	0.15
Dec., 14	23.74	12.45	89.58	70.03	0	0	2.44	4.45	0.10
Jan., 15	23.20	11.92	85.87	60.39	2.0	1	2.63	5.17	0.07
Feb., 15	27.66	15.44	80.32	59.21	7.0	1	3.48	5.76	0.13
Mar., 15	32.21	19.07	65.03	46.84	12.0	2	4.19	7.37	0.22

#### Installation of Surface Observatory by IMD, Kolkata

India Meteorological Department/ Regional Meteorological Centre, Kolkata installed surface Meteorological observatory in the campus of CSR&TI, Berhampore for daily recording and transmission of meteorological data at 3.30 GMT (8.30hrs) and 12.30 GMT (17.30hrs).

### II. REGIONAL SERICULTURAL RESEARCH STATION:

#### A. KALIMPONG, WEST BENGAL

Meteorological data on Temperature, Relative humidity & Rainfall at RSRS farm

Month	Temperature (°C)			Relative Humidity (%)			Rainfall (mm)	Rainy days
	Max	Min	Mean	Max	Min	Mean		
April, 2014	29.53	16.47	23.00	79.47	35.03	57.25	44.50	09
May, 2014	28.10	18.35	23.23	93.58	57.42	75.50	202.82	14
June, 2014	29.90	21.30	25.60	98.37	62.90	80.63	450.52	21
July, 2014	30.42	21.48	25.90	98.13	61.77	80.18	329.20	25
Aug., 2014	28.65	21.03	24.84	99.00	68.10	83.57	517.20	26
Sept., 2014	28.97	19.90	24.43	95.70	62.13	78.92	266.30	19
Oct., 2014	28.45	16.68	22.56	94.39	46.87	70.63	27.00	06
Nov., 2014	24.97	14.03	19.50	92.97	47.20	70.08	0.00	00
Dec., 2014	23.06	10.45	16.76	88.61	38.77	63.69	2.70	01
Jan., 2015	22.93	11.14	17.04	86.96	41.64	63.20	28.10	03
Feb., 2015	21.87	9.42	15.65	84.74	37.26	60.23	3.70	04
Mar., 2015	25.65	14.29	19.97	83.68	42.26	62.97	39.06	07
Avg/Total	26.88	16.21	21.54	91.30	50.11	70.57	1911.1	135

#### B. KORAPUT, ODISHA (At RSRS farm)

Month & Year	Temperature (°C)		R H (%)		Rainfall (mm)	Rainy Days (No)
	Min.	Max.	Min.	Max.		
April, 2014	20.0	39.2	20.72	78.57	33.7	6



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May, 2014	19.4	39.9	28.74	82.04	164.2	18
June, 2014	20.5	37.2	53.28	92.85	177.5	18
July, 2014	19.3	27.8	83.85	98.63	564.3	23
Aug., 2014	20.6	32.7	64.68	98.96	371.3	27
Sept., 2014	19.3	34.80	54.98	97.57	235.0	21
Oct., 2014	15.2	32.7	40.33	97.43	134.5	6
Nov., 2014	12.2	31.1	24.68	97.58	17.7	2
Dec., 2014	8.8	31.4	28.09	96.86	7.6	2
Jan., 2015	8.3	30.2	22.55	95.58	1.5	1
Feb., 2015	12.4	35.2	14.56	84.18	27.8	1
Mar., 2015	17.2	37.1	19.36	80.53	29.5	4
Avg./Total	16.1	34.12	37.99	91.73	1764.6	129

### **C. RANCHI, JHARKHAND (At RSRs farm)**

Month	Temp ( <sup>o</sup> C)		R.H. (%)		Rainfall (mm)
	Max.	Min.	Max.	Min.	
April, 2014	36.37	21.97	51.17	33.63	–
May, 2014	35.55	27.55	58.94	34.19	–
June, 2014	34.13	25.87	75.47	51.97	–
July, 2014	35.00	22.81	81.87	72.32	118.5
Aug., 2014	28.90	24.42	86.13	74.81	107.9
Sept., 2014	27.5	23.87	85.87	75.23	202.2
Oct., 2014	26.22	22.00	77.96	65.58	–
Nov., 2014	22.53	15.76	62.93	46.66	–
Dec., 2014	19.54	12.90	56.80	42.51	–
Jan., 2015	20.32	12.48	77.48	58.45	–
Feb., 2015	22.52	14.18	71.65	55.19	–
Mar. 2015	26.35	15.35	62.25	54.26	34.25
Avg./Total	27.91	19.93	70.71	55.4	448.05

### **D. JORHAT, ASSAM (At RSRs farm)**

Date	Temperature ( <sup>o</sup> C)		RH%		Rainfall (mm)
	Max.	Min.	Max.	Min.	
April, 2014	33	19	91	35	55.00
May, 2014	32	22	98	55	234.00
June, 2014	34	25	98	54	509.00
July, 2014	35	26	97	55	151.00
Aug., 2014	34	26	98	57	372.00
Sept., 2014	32	25	99	60	157.00
Oct., 2014	31	22	99	55	63.00
Nov., 2014	26	17	99	58	0
Dec., 2014	23	12	99	62	0
Jan., 2015	25	11	99	33	15.00
Feb., 2015	26	11	97	32	0.20
Mar., 2015	31	17	95	41	29.00
Avg./Total	30.17	19.42	97.42	49.75	1585.20



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### 30. ADMINISTRATIVE & FINANCIAL REPORT

Central Sericultural Research & Training Institute, Berhampore (West Bengal) and its allied units are as follows:

#### A. STAFF POSITION : MAIN INSTITUTE

Category	Sanctioned	Filled	Vacant
Director	01	01	-
Scientific	33	26	07
Technical	82	71	11
Administrative	85	71	14
Supporting	-	-	-
<b>Total</b>			

#### B. OFFICERS & STAFF RETIRED:

Sl. No.	Name of the employees	Designation	Date of retirement
1.	Shri Tapan Kumar Pal	Sr.Technical Assistant	30.04.2014
2.	Smt. Sanjukta Roy (Raha)	Sr.Technical Assistant	30.04.2014
3.	Shri Maloy Kumar Roy	Dy. Director(A&A)	30.04.2014
4.	Shri Arun Kumar Nandi	Staff Car Driver (SG)	31.05.2014
5.	Dr. S.P.Chakrabarty	Scientist-D	31.05.2014
6.	Shri Chandi Mandal	Attender	30.06.2014
7.	Shri Nirvan Kumar Das	A.D. (Stat.)	30.06.2014
8.	Shri S.S.Manna	Sci-D	30.06.2014
9.	Shri P.D.Mishra	A.D.(A&A)	30.06.2014
10.	Shri Biren Mistry	Sr.T.A.	30.06.2014
11.	Shri P.B.Chakrabarty	Asst. Supdt.	31.07.2014
12.	Shri Dilip Kumar Malakar	Attender	31.07.2014
12.	Dr. Safikur Rahaman	Sci-C	30.09.2014
13.	Shri Tapas Kr. Roy	Sr.Technical Assistant	31.10.2014
14.	Dr. G. K. Chattopadhyay	Sci-D	31.10.2014
15.	Dr. M.K.Singh	Sci-D	31.12.2014
16.	Smt. Aloka Hazra	Safaiwala	31.01.2015
17.	Shri Swapan Kumar Roy	Sr.Technical Assistant	28.02.2015
18.	Dr. K.M.Purohit	Scientist-C	31.03.2015
19.	Shri Rushi Sahoo	Scientist-C	31.03.2015
20.	Dr. S.K.Mandal	Scientist-D	31.03.2015
<b>OFFICERS &amp; STAFF (Voluntary Retirement)</b>			
1	Dr. M.V.Santha Kumar	Sci-D	05.01.2015

#### C. BUDGET (Rs. in lakh): (2014-15)

Non-Plan	Plan-Gen	Plan-Cap	NE		Total
			Gen	Cap	
2444.51	365.39	161.54	312.78	19.78	3304.00



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