सं./No. 50

वार्षिक प्रतिवेदन
ANNUAL REPORT
2013-14

कैंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान

(आई एस ओ 9001 : 2008 प्रमाणित)

कैंद्रीय रेशम बोर्ड, वस्त्र मंत्रालय, भारत सरकार,

मैसूर - 570 008

CENTRAL SERICULTURAL RESEARCH & TRAINING INSTITUTE

(ISO 9001 : 2008 Certified)

Central Silk Board- Min. of Textiles - Govt. of India,

MYSORE - 570 008

CSR&TI
ORGANIZATIONAL SET-UP

DIRECTOR

- Host Plant
  - Improvement
  - Production
  - Protection
- Silkworm
  - Improvement
  - Production
  - Protection
  - **Post Cocoon** evaluation unit
- Extension
  - **Nested units**
  - **Library &** Information Centre
- Training
- SED
- PMCE
  - Bioinformatics Centre
  - Computer Centre
  - Publicity/ Publications
- Others
  - Accounts & Bills
  - Establishment
  - Stores/ Procurement
  - Maintenance
  - Official Language Implemenation Cell

PMCE - Planning, Monitoring, Coordination & Evaluation
SED - Sericulture Engineering Division
- Support Services

सं./No. 50

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Central Silk Board, Ministry of Textiles, Govt. of India, Mysore-570 008

प्रधान संपादक

डॉ बी बी बिन्द्रू
निदेशक
केंरेअप्रसं, मैसूर

संपादक
डॉ विनीत कुमार
डॉ अश्वत्थ एस के
श्री मुनिकृष्णप्पा एच एम
श्रीमती रेखा एम

संकलन/संपादकीय सहायता
श्री मंजुनाथ एन.के.

हिन्दी अनुवाद
डॉ जयरामुलु बी.
श्रीमती जयश्री वी
श्रीमती शचि के
श्रीमती वसंता कुमारी वी.सी.

सहायता
श्री वसंत कुमार के

मुख पृष्ठ सज्जा
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मुद्रण
सर्वश्री रेडी प्रिन्ट्स, मैसूर
प्रतियां : 100

जून, 2014

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Printed by
M/s. Ready Prints, Mysore
No. of Copies: 100

June, 2014

डॉ बी बी बिन्द्रू, निदेशक, केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, मैसूर द्वारा प्रकाशित
Published by: Dr. B. B. Bindroo, Director, Central Sericultural Research and Training Institute, Mysore.

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प्रस्तावना

केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, मैसूर की वर्ष 2013-14 की वार्षिक रिपोर्ट को प्रकाशित करते हुए मुझे अत्यंत प्रसन्नता हो रही है । मुड़कर देखने पर अनुभव होता है कि यह वर्ष अनेक उपलब्धियों वाला एक असाधारण और विशिष्ट वर्ष रहा और इन उपलब्धियों में एक है संस्थान के आई एस ओ 9001:2008 से प्रमाणित किया जाना । यह रेशम उत्पादन के विकास हेतु अनुसंधान व विकास में गुणवत्ता प्रबंधन, विस्तारण और समर्थन सेवाओं में उत्कृष्टता के लिए हमारी सशक्त वचनबद्धता का प्रमाण है ।

वर्ष के दौरान संस्थान ने परिणाम ढ़ाँचा दस्तावेज (आर एफ डी) को अपनाया और निर्धारित लक्ष्य प्राप्त किए। संस्थान और इसके संबद्ध एककों ने 57 अनुसंधान परियोजनाओं/कार्यक्रमों को आरंभ किया जिसमें से 8 बाहर से निधि प्राप्त परियोजनाएँ है । कुल 11 अनुसंधान परियोजनाएं और 10 कार्यक्रम सम्पन्न हुए ।

यह संतोषजनक बात है कि पोषी पादप सुधार पर अनुसंधान से तीन आर्द्रता प्रतिबल सहनशील शहतूत उपजाति यथा, संस्थान में एम एस जी2, चामराजनगर में एम एस जी 7 और अनंतपुर में एम एस जी 26 की प्राप्ति हुई जिससे उपज में एस 13 की अपेक्षा 17-35% सुधार हुआ । शहतूत सुधार कार्यक्रमों में अधिक उपयोगिता और संरक्षण हेतु 150 शहतूत जननद्रव्य ऐक्सेशन का विकास किया गया । यूरिया के साथ नाइट्रीकरण रोधी के प्रयोग पर अध्ययन ने मृदा में नाइट्रोजन उपयोग करने की क्षमता और जैव कार्बन अंश की संभावना को दर्शाया है । दक्षिण राज्यों के 200 से अधिक प्रतिदर्शों ने दर्शाया कि मृदा पी एच, ओ सी और स्थूल घनत्व ही मुख्य कारक हैं जो मृदा से पोषक तत्वों के उद्ग्रहण को प्रभावित करती है ।

संस्थान और इसके क्षेत्रीय केंद्रों ने 2000 से अधिक पणधारियों को उपयुक्त उर्वरक सिफारिशों के साथ मृदा परीक्षण सेवाएं भी प्रदान की है । यह नोट करने योग्य है कि शहतूत के मूल विगलन रोग के नियंत्रण के लिए एंडोफाइटिक जीवाणु जैव नियंत्रण कारक का संघ विकसित किया गया है जो कि रोग को 80% तक नियंत्रित करता है । इसके अतिरिक्त मूल गांठ रोगजनक के प्रबंधन के लिए विकसित पारि अनुकूल सूत्रीकरण, निमाहारी को दक्षिण राज्यों के किसानों के माध्यम से परीक्षण कर सफल पाया गया ।

रेशमकीट विभाग के अंतर्गत ताप सहिष्णु रेशमकीट नस्ल को विकासित करने के लिए आण्विक मार्कर सहायता वाले चयन की कार्य नीति को अपनाया गया । जिसमें चयन कार्यविधि के दौरान बी एम एन ओ एक्स प्रोटीन का उपयोग करते हुए एस एस आर मार्कर और एन पी वी सहिष्णु रेशमकीट नस्लों का प्रयोग किया गया । वर्ष के दौरान उन्नत संकर नस्लों (आई सी बी) का विकास किया गया और आठ एन पी वी/ ताप सहिष्णु वंशक्रम का मूल्यांकन हो रहा है । 2ए-3ए ग्रेड रेशम के उत्पादन के साथ आई सी बी, एल14 x सी.एस.आर2 के प्रचार के लिए विशेष महत्व दिया गया और 1.5 लाख से अधिक रोग मुक्त बीज चकत्तें वितरित किए गए और परिणाम संतोषजनक है । बीज तथा वाणिज्यिक कीटपालकों के हित के लिए एल14 शुद्ध नस्ल और संकर दोनों हेतु कीटपालन पैकेज विकसित किए गए । आगे, एल14 x सी.एस.आर2 कोसों के प्रभावशाली धागाकरण के लिए विकसित एक संशोधित धागाकरण प्रौद्योगिकी पैकेज क्षेत्र परीक्षण के अधीन है । एल14 शुद्ध नस्ल के सुधार के लिए प्रजनन विशेषज्ञों के एक विशेष दल को गठित किया गया है और उन्नत वंशक्रम का चयन किया जा रहा है ।

कार्डिसेप्स, जो कि औषधीय उपयोग हेतु एक उत्तम उत्पाद है के संवर्धन हेतु देशी रीति अपनाई गई । रेशमकीट का प्रयोग करते हुए जीवे में और संवर्धन माध्यम से पात्रे में यह रीति अपनाई गई । अध्ययन ने दर्शया कि मीटालडीहाइड, जो कि रेशमकीटों के लिए सही है को शहतूत बागान में जायंट आफ्रीकन स्नेल्स के प्रभावशाली प्रबंधन हेतु प्रयोग कर सकते है । पेब्रिन के नियंत्रण हेतु नई कार्य नीति विकसित करने के लिए, एम ई टी ए पी2 जीन को क्रमबद्ध किया गया जिसने मधुमक्खी के साथ समानता दर्शाई और परिणामों ने चिकित्सीय नियंत्रण हेतु रासायनिक मिश्रण का पता लगाया । कीटपालन गृहों के विसंक्रमण हेतु उपयोग अनुकूल प्रौद्योगिकी को तैयार किया गया जो कि रेशमकीट पालन में होने वाली नीरसता को कम करता है और विसंक्रमण से बचाता है । एक प्रोबयोटिक जीवाणु को पहचाना गया जो रेशमकीट के रोगजनक जीवाणु का विरोधी है ।

पीड़क और रोग प्रबंधन हेतु पारिअनुकूल प्रौद्योगिकियों को विकसित करने हेतु इस संस्थान ने मेहनत की और इस पर जोर दिया । ऊजी मक्खी के नियंत्रण हेतु विकसित कताई उत्तर गैर रासायनिक पैकेज को कर्नाटक के एक पूरे गाँव ने अपनाया और 600 से अधिक फसलों पर प्रयोग किया जिसके परिणाम स्वरूप ऊजी मक्खी का उत्पीड़न काफी कम हो गया । संस्थान के परिसर में जैवनियंत्रण कारकों के अत्यधिक प्रयोग से मिली बग और लिपिडोपटरन पीड़कों का आपतन 5% से भी कम हो गया ।

विस्तारण क्षेत्रों में सराहनीय प्रगति हुई है जहाँ 106 समूहों में समूह संवर्धन कार्यक्रमों को सफलता पूर्वक कार्यान्वित किया गया जिसके परिणामस्वरूप शहतूत का विस्तारण 16000 एकड़ से अधिक हो गया जिससे 1420 मी टन द्विप्रज कच्चा रेशम का उत्पादन हुआ । चॉकी कीटपालन केंद्रों के मालिकों को समस्याओं और सम्भावनाओं की चर्चा करने की सुविधा प्रदान करने हेतु चॉकी कीटपालन केंद्रों की भूमिका पर कार्यशाला आयोजित की गई जिसमें दक्षिण राज्यों के चॉकी कीटपालन केंद्रों के मालिक, समूह संवर्धन सुसाध्यकों और रेशम उत्पादन विभाग के पदाधिकारियों ने भाग लिया । इसके अतिरिक्त कृषकों की कार्याशाला आयोजित की गई जिसमें कर्नाटक के सभी 30 जिलों का प्रतिनिधित्व करते हुए 1800 से अधिक किसानों ने भाग लिया । संस्थान और इसके संबद्ध एककों ने विस्तारण संचार कार्यक्रमों में प्रशंसनीय उपलब्धि प्राप्त की है जिससे 25000 से अधिक रेशम उत्पादक प्रभावित हुए ।

संस्थान का मुख्य केंद्रबिन्दु मानव संसाधन विकास रहा है जिसमें वस्त्र मंत्रालय के प्रतिष्ठित एकीकृत कुशलता विकास योजना (आई एस डी एस) कार्यक्रम के अंतर्गत 518 लाभार्थी प्रशिक्षित हुए । इसके अतिरिक्त संस्थान और संबद्ध एककों द्वारा संरचना एवं आवश्यकता आधारित कार्यक्रमों के अधीन 1500 से अधिक व्यक्तियों को प्रशिक्षण दिया गया । इसके अलावा बंगलादेश और अफगनिस्तान से 21 पदधारियों के लिए अंतर्राष्ट्रीय प्रशिक्षण कार्यक्रम आयोजित किया गया ।

यह प्रशंसनीय है कि संस्थान में पहली बार साप्ताहिक संगोष्ठियाँ आयोजित की गई जिसमें शहतूत, रेशम उत्पादन, प्रशिक्षण और विस्तारण क्षेत्रों के सभी पहलुओं को सम्मिलित करते हुए वैज्ञानिकों द्वारा 40 विषय प्रस्तुत किए गए ।

वर्ष के दौरान आरंभ किए गए विशेष नए कार्य है- नवंबर 2013 से जीवमितीय उपस्थिति प्रणाली का प्रारंभ और संस्थान में वीडियो सम्मेलन स्टूडियो की स्थापना । ये कार्य प्रशासन और संचार में पारदर्शिता और सक्षमता सुनिश्चित करने में सहायक होंगे ।

संस्थान ने प्रचार और प्रकाशन में भी प्रभावशाली प्रगति की है जिसमें 71 शोध-पत्र, के अलावा न्यूज़ रिपोर्ट, रेशम संक्षेप, विस्तारण नियमावली, पुस्तक/पुस्तिकाएँ और तकनीकी बुलेटिन सहित 100 प्रचार सामग्रियाँ सम्मिलित हैं । इसके अलावा संगोष्ठियाँ/कार्यशालाओं/सम्मेलनों में 87 लेख प्रस्तुत किए गए । संस्थान ने वार्षिक रिपोर्ट और अन्य रिपोर्टों के अतिरिक्त इंडियन जर्नल ऑफ सेरिकल्चर के दो अंक, सेरिडॉक और रेशम किरण (हिन्दी) के भी दो-दो अंक प्रकाशित किए हैं ।

अनुसंधान समन्वयन समिति, अनुसंधान सलाहकार समिति और क्षेत्रीय अनुसंधान समन्वयन समिति के अध्यक्ष और सदस्यों का मैं आभार प्रकट करना चाहता हूँ जिनके बहुमूल्य मार्गदर्शन और सहयोग ने अनुसंधान एवं विकास, प्रशिक्षण और विस्तार कार्यकलापों को सरल और कारगर बना दिया । मैं विभिन्न राज्यों के रेशम उत्पादन विभागों के सहयोग के लिए भी आभारी हूँ जिनकी सहायता से निर्धारित लक्ष्य प्राप्त किए गए । संस्थान और इसके संबद्ध एककों के सभी वैज्ञानिक और कर्मचारी प्रशंसा के पात्र हैं जिन्होंने इस वर्ष के दौरान आश्चर्यजनक प्रगति प्राप्त करने हेतु अपना अमूल्य सहयोग और समर्थन दिया ।

भा भ बिन्दु

डॉ बी बी बिन्द्रू
निदेशक

FOREWORD

I have great pleasure in bringing out the Annual Report of Central Sericultural Research and Training Institute, Mysore for the year 2013-14. Looking back, it has been an exceptional year due to a number of remarkable accomplishments and one of them being accreditation of the Institute with the ISO 9001:2008 certification which is a testimony of our strong commitment to excellence in quality management of R & D, extension and support services for development of sericulture.

During the year, the Institute has adopted the Results Framework Documentation (RFD) and achieved the set targets. The Institute and its nested units initiated 57 research projects/programmes including 8 external funded projects. A total of 11 research projects and 10 programmes were concluded.

It is gratifying to note that research on host plant improvement has come out with three moisture stress tolerant mulberry varieties, *viz.*, MSG2 at the Institute, MSG7 at Chamarajanagar and MSG 26 at Ananthapur with 17-35% improvement in yield over S13. A core assembly of 150 mulberry germplasm accessions has been developed for sustainable conservation and enhanced utilisation in mulberry improvement programmes. Studies on the use of nitrification inhibitors along with urea has shown the prospects of increasing the nitrogen use efficiency and organic carbon content in the soil. Soil analysis of over 200 samples of southern states has revealed that soil pH, OC and bulk density are the major factors influencing nutrient uptake from the soil.

The Institute and its Regional Stations have offered soil testing services to over 2000 stakeholders with suitable fertiliser recommendations. It is noteworthy that for control of root rot disease of mulberry a consortium of endophytic bacterial biocontrol agents have been developed which can suppress the disease upto 80%. Further, Nemahari, the eco-friendly formulation developed for management of root knot pathogen, has been successfully tested with farmers of southern states.

On silkworm front, new strategy of molecular marker assisted selection was taken up for developing thermo-tolerant silkworm breeds using SSR markers as well as NPV tolerant silkworm breeds employing BmNOX protein during the selection process and the lines are under fixation. Development of improved cross breeds (ICB) was continued during the year and eight NPV/thermo-tolerant lines are under mid-way evaluation. Special emphasis has been made for popularisation of the ICB, L14 x CSR2 with the potential to produce 2A-3A grade silk and over 1.5 lakh DFLs have been distributed and the results are encouraging. Rearing package for both L14 pure breed and hybrid was developed for the benefit of the seed and commercial rearers. Further, a modified reeling technology package developed for effective reeling of L14 x CSR2 cocoons is under field trial. A special team of breeding experts has been constituted for improvement of L14 pure breed through multi-locational breeding cycles and the improved lines are being short-listed.

An Indigenous method of culturing *Cordyceps*, which is a high value product for pharmaceutical applications has been developed, both *in vivo* using silkworm and *in vitro* through culture media for which patent has been applied. Studies have shown that metaldehyde, which is safe to silkworms, can be conveniently used for effective management of giant African snails in the mulberry garden. For developing new strategies for controlling pebrine, MetAP2 gene has been sequenced which showed similarity with that of honey bee and the findings could lead to identification of chemical compounds for therapeutic control. An user friendly technology for disinfection of rearing sheds using micro-jets was fine tuned which will reduce drudgery in silkworm rearing and saves the disinfectants. A known probiotic bacteria which is antagonistic to other bacteria pathogenic to silkworm has been isolated.

Developing eco-friendly technologies for pest and disease management has been the major thrust of the Institute. A post-spinning non-chemical package developed for control of uzi fly has been successfully adopted in an entire village in Karnataka covering over 600 crops which has resulted in curtailment of uzi infestation below 2%. Extensive release of biocontrol agents in the Institute campus has brought down the incidence of mealy bugs and lepidopteran pests below 5%.

Commendable progress was achieved in the extension front, where in CPP programme was successfully implemented in 106 clusters which has resulted in expansion of mulberry by over 16000 acres leading to a record production of 1420 MT of bivoltine raw silk. To provide a platform for the CRC owners to discuss the problems and prospects, a workshop on the role of CRCs was organised involving the owners of CRCs, CDFs and DoS officials of southern states. Further, a mega farmers' workshop was organised in which over 1800 farmers representing all the 30 districts of Karnataka participated. Remarkable achievement has been made by the Institute and nested units with regard to extension communication programmes, where over 30,000 sericulturists have been sensitised on the new technologies.

HRD has been the major focus of the Institute, where in a total of 518 beneficiaries were trained under the prestigious ISDS programme of MOT. Further, over 1500 persons have been trained under structured and need based programmes by the Institute and nested units. Besides, international training programmes were organized for 21 officials each from Bangladesh and Afghanistan.

It is laudable that for the first time, weekly seminars were organized by the Institute, in which 40 topics covering all facets of mulberry sericulture, training and extension areas were presented by the scientists.

The new ventures initiated during the year are introduction of the biometric attendance system since November 2013 as well as establishment of a state-of-the art Video Conference studio in the Institute. These initiatives will greatly help in ensuring transparency and efficiency in administration and communication.

The Institute made an impressive progress in publicity and publications covering 71 research papers, 100 publicity materials including news reports, silk briefs, extension manuals, books/booklets and technical bulletins. Further, 87 papers were presented in seminar/workshop/ conferences. The institute has brought out two issues of *Indian Journal of Sericulture*, two issues each of *Seridoc* and *Resham Kiran* (*Hindi*) in addition to the Annual Report and the other Technical Reports.

I wish to express my sincere thanks to the learned Chairmen and members of the RCC, RAC, RRAC for their valuable guidance and inputs for streamlining the R & D, training and Extension activities as well as the support of DoS of different states for their help in achieving the set targets. The scientists and staff of the Institute and nested units deserve my full appreciation for their invaluable cooperation and support for the marvellous progress achieved during the year.

Dr. B.B. Bindroo
Director

I. कें.रे.अ.प्र.सं. मैसूर के बारे में

केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, मैसूर केंद्रीय रेशम बोर्ड, वस्त्र मंत्रालय, भारत सरकार के संरक्षण में संस्थापित हुआ और पुराने मैसूर प्रांत के रेशम उत्पादन अनुसंधान संस्थान को लेने के बाद वर्ष 1961 में चन्नपट्टणा में इसका कार्य प्रारंभ हुआ। इसे वर्ष 1963 में मैसूर में स्थानांतरित किया गया । प्रशिक्षण घटक को सम्मिलित करने के बाद इस संस्थान का वर्ष 1965 में केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, मैसूर के रूप में पुर्ननामकरण किया गया । यह संस्थान देश में रेशम उद्योग के विकास के लिए पिछले 60 सालों से अच्छी सेवाएं समर्पित कर रहा है ।

आज यह संस्थान समस्त आधुनिक सुविधाओं एवं अवसंरचनायुक्त रेशम उत्पादन अनुसंधान के उत्कृष्ट प्रमुख संस्थान के रूप में विख्यात है । गत दशकों में इस संस्थान की महत्ता बढ़ गई और इसे राष्ट्रीय एवं अंतर्राष्ट्रीय ख्याति प्राप्त हुई है । यह संस्थान कर्नाटक, आंध्रप्रदेश, तमिलनाडु, केरल, महाराष्ट्र एवं मध्यप्रदेश में शहतूत रेशम उद्योग के कृषि क्षेत्र में आवश्यकताओं की पूर्ति करने हेतु रेशम उत्पादन अनुसंधान व विकास संबंधी सभी कार्यकलापों को लेता है। इस संस्थान ने अपनी सुविकसित अवसंरचना एवं देशीय विकसित सक्षम प्रौद्योगिकी आधार पर देश में उष्णकटिबंधीय रेशम उत्पादन में अग्रणी अनुसंधान व विकास संस्थान के रूप में यश प्राप्त किया है और इसे अंतर्राष्ट्रीय स्तर पर उच्च अध्ययन एवं उन्नत प्रशिक्षण केंद्र के रूप में मान्यता प्राप्त है । प्रशिक्षित मानव संसाधन उत्पन्न करने में राष्ट्रीय एवं अंतर्राष्ट्रीय दोनों स्तरों पर इसकी भूमिका हमेशा महत्वपूर्ण रही । अभी तक इस संस्थान ने रेशम उत्पादन विज्ञान व प्रौद्योगिकी के विभिन्न पहलुओं में 749 विदेशियों सहित करीब 35,000 व्यक्तियों को प्रशिक्षित किया है । यह संस्थान अनुसंधान एवं प्रशिक्षण कार्य संचालित करने के अलावा राष्ट्रीय एवं अंतर्राष्ट्रीय अभिकरणों को परामर्श एवं सलाहकारी सेवाएँ भी प्रदान करता है ।

दृष्टि

ग्रामीण विकास एवं उन्नयन के लिए रेशम उत्पादन में अनुसंधान व विकास सेवाएँ प्रदान करने तथा देशी और अंतर्राष्ट्रीय स्तर पर विशेषतया उष्णकटिबंधीय देशों में मानव संसाधन उत्पन्न करने में आदर्श संगठन बनना है।

लक्ष्य

- उत्पादन लागत कम करने के अलावा रेशम उत्पादकता एवं गुणवत्ता को बढ़ाना ।
- संसाधनों की प्रभावकारी उपयोगिता हेतु परिस्थिति अनुकूल और गरीबों तथा महिलाओं के लिए अनुकूल प्रौद्योगिकियाँ विकसित करना ।
- पणधारियों की सामाजिक - आर्थिक स्थितियों को समग्र रूप से विकसित करने के लिए निम्नलागत की नवाचारी प्रौद्योगिकियाँ विकसित करना ।
- प्रचालन के सभी स्तरों के लिए मानव संसाधन विकसित करना ।
- गुणवत्ता रेशम के उत्पादन आधार को बढ़ाने के लिए कृषि क्षेत्र में आधुनिक प्रौद्योगिकियों का प्रवर्तन कर लोकप्रिय बनाना ।

अधिदेश

- विभिन्न कृषिजलवायु स्थितियों/क्षेत्रों के लिए उपयुक्त शहतूत रेशम उत्पादन प्रौद्योगिकियाँ विकसित करना ।

- समुचित प्रौद्योगिकियाँ विकसित करने हेतु विभिन्न विषयों पर मूल एवं अनुप्रयुक्त अनुसंधान संचालित करना ।
- साबित प्रौद्योगिकियों को अपनाने हेतु क्षेत्र स्तर पर नमूना परीक्षण करना ।
- विकसित प्रौद्योगिकियों का क्षेत्र में अग्र पंक्ति एवं प्रथम पंक्ति निदर्शन संचालित करना।
- मानव संसाधन विकास और प्रशिक्षण कार्यक्रमों को संचालित करना ।
- केंद्रीय रेशम बोर्ड संस्थानों में विकसित या अन्य अभिकरणों द्वारा विचारार्थ प्रेषित शहतूत रेशम उत्पादन संबंधी कीटपालन उपस्करों, यंत्रों, उत्पादों और प्रौद्योगिकियों के लिए परीक्षण केंद्र के रूप में सेवा करना ।
- सहयोगी अनुसंधान एवं प्रौद्योगिकी स्थानांतरण के लिए राज्य सरकारों, स्वयंसेवी संगठनों, गैर सरकारी संगठनों, विश्वविद्यालयों और अन्य राष्ट्रीय संस्थानों के साथ समन्वयन करना ।

संगठनात्मक रचना

केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, मैसूर, देश में रेशम उत्पादन अनुसंधान विकास कार्य में लगा हुआ सबसे बड़ा और अधिक वैविध्यपूर्ण संस्थान है जो कृषि इंजीनियरों, समाजशास्त्रियों एवं अर्थशास्त्रियों सहित करीब 150 वैज्ञानिकों से समर्थित है । ये कर्नाटक, तमिलनाडु, आँधप्रदेश, केरल, महाराष्ट्र और मध्यप्रदेश राज्यों के मुख्य संस्थानों और संबद्ध एककों में समुचित प्रौद्योगिकियों के विकास और उनके स्थानांतरण हेतु समन्वय से कार्य कर रहे हैं। अनुसंधान व विकास कार्यकलाप और प्रौद्योगिकी विकास कार्य चार प्रमुख प्रभागों यथा पोषी पादप, रेशमकीट, विस्तार एवं प्रशिक्षण के विभिन्न अनुभागों में किए जा रहे हैं । योजना, अनुवीक्षण, समन्वयन एवं मूल्यांकन कक्ष की सहायता से निदेशक, संस्थान और इसके संबद्ध एककों के अनुसंधान व विकास कार्यकलापों की प्रगति का अनुवीक्षण करते हैं ।

विस्तार कार्य-तंत्र

प्रयोगशाला उपलब्धियों के मान्यकरण में एवं उन्हें क्षेत्र में प्रभावी ढंग से स्थानांतरित करने में सुगम बनाने हेतु इस संस्थान के तीन स्तरीय विस्तारण कार्य-तंत्र हैं - **क्षेत्रीय रेशम उत्पादन अनुसंधान केंद्र** (क्षे रे अ कें), **अनुसंधान विस्तारण केंद्र** (अ वि कें) और **उपएकक**। दक्षिणी राज्यों के मुख्य रेशम उत्पादन अंचलों स्थित क्षेत्रीय रेशम उत्पादन अनुसंधान केंद्र क्षेत्र विशेष के अनुकूल और प्रायोगिक अनुसंधान संचालित करते हैं । कृषकों और विस्तारण कर्मचारियों को प्रशिक्षित करने के अतिरिक्त क्षेत्रीय आवश्यकताओं के लिए उपयुक्त प्रौद्योगिकियों की सिफारिश करने हेतु प्रौद्योगिकी परीक्षण किया जाता है । लाभार्थियों को प्रौद्योगिकी का स्थानांतरण करना और उनकी सहायता के लिए सभी प्रौद्योगिक निवेश देने का उत्तरदायित्व अनुसंधान विस्तारण केंद्र एवं उप-एककों का है । क्षेत्रीय कृषि विश्वविद्यालयों के साथ सक्रिय सहयोग आरंभ करते हुए यह संस्थान रेशम उत्पादन प्रौद्योगिकियों का प्रभावी स्थानांतरण करने के लिए कर्नाटक, आंध्रप्रदेश और तमिलनाडु में वीडियो सम्मेलन सत्र संचालित कर रहा है । कृषक सलाहकार केंद्र में कियोस्क संस्थापित है और सभी प्रौद्योगिकियों के विवरण कृषक संग्रहालय में उपलब्ध हैं ।

प्रशिक्षण केन्द्र

इस संस्थान को उष्णकटिबंधीय रेशम उत्पादन के क्षेत्र में प्रशिक्षित मानव संसाधन विकसित करने हेतु अग्रगामी केन्द्र के रूप में मान्यता प्राप्त है । यह दोनों राष्ट्रीय एवं अंतर्राष्ट्रीय स्तर पर उष्णकटिबंधीय रेशम उत्पादन में प्रशिक्षण देता है । यह संस्थान रेशम उत्पादन प्रौद्यागिकी एवं जैव सूचना विज्ञान में अनुसंधान एवं रेशम उत्पादन में पीएच डी कार्यक्रम संचालित करने हेतु मैसूर विश्वविद्यालय से संबद्ध है । इस

संस्थान को विभिन्न प्रशिक्षण कार्यक्रम विशेषकर ग्रामीण गरीब लोगों, कमज़ोर वर्गों और महिला रेशम उत्पादकों के सामाजिक-आर्थिक विकास के लिए और प्रौद्योगिक सशक्तिकरण हेतु संचालित करने के लिए भी जैव प्रौद्योगिकी विभाग एवं विज्ञान व प्रौद्योगिकी विभाग, भारत सरकार से मान्यता प्राप्त है। यह संस्थान राज्य रेशम उत्पादन विभागों की मानव संसाधन विकास आवश्यकताओं को पूरा करने के अलावा जापान अंतर्राष्ट्रीय रेशम उत्पादन प्रशिक्षण कार्यक्रम भी संचालित कर रहा है।

प्रशिक्षण स्कंध में दृश्य-श्रव्य शिक्षण उपस्करों से सुसज्जित कक्षाएँ हैं और विभिन्न विश्वविद्यालयों से मान्यता प्राप्त योग्य संकाय सदस्यों द्वारा कार्यक्रम संचालित किए जाते हैं । करीब 125 व्यक्तियों को ठहराने हेतु छात्रावास सुविधाएँ उपलब्ध हैं।

उपलब्ध अवसंरचना सुविधाएँ

- रेशम उत्पादन विज्ञान में उन्नत अनुसंधान संचालित करने हेतु सुसज्जित प्रयोगशालाएँ, शहतूत बाग़ और कीटपालनगृह ।
- प्रौद्योगिकी मान्यकरण एवं किसानों को प्रशिक्षण देने हेतु बड़े पैमाने पर कीटपालन गृह।
- चॉकी कीटपालन केन्द्र संकल्पना के संवर्धन के लिए 6000 रो मु बी च क्षमता वाला आदर्श चॉकी कीटपालन केन्द्र ।
- यंत्रों/उपस्करों के अभिकल्प एवं विकास तथा संरचना में सहारा देने हेतु कार्यशाला सुविधाओं से युक्त रेशम उत्पादन अभियांत्रिकी प्रभाग ।
- पदधारियों के लिए जीवमितीय उपस्थिति प्रणाली ।
- कें रे अ प्र सं, मैसूर ने प्रयोगशाला से क्षेत्रों में प्रौद्योगिकी स्थानांतरण को सक्षम बनाने और शीघ्र संचार को सुनिश्चित करने हेतु स्टेट ऑफ आर्ट प्रौद्योगिकी वाले नए विडियो सम्मेलन स्टुडियो की स्थापना की, जिसके कारण अधीनस्थ एककों, रेशम उत्पादन विभागों और अन्य संगठनों के साथ प्रभावशाली पारस्परिक संबंध बनाने में आसानी हुई।
- लान के माध्यम से कंप्यूटर केंद्र द्वारा सभी अनुभागों को इंटरनेट संयोजन प्रदान किया गया है । लान, कंप्यूटरों में प्रिंट/फाइल शेयरिंग में भी सहायता करता है ।
- जैव प्रौद्योगिकी विभाग की वित्तीय सहायता से राष्ट्रीय जैव सूचना विज्ञान जालतंत्र के अंतर्गत स्थापित जैव सूचना विज्ञान केन्द्र दक्षिण राज्यों में रेशम जैव प्रौद्योगिकी अनुसंधान में सम्मिलित विभिन्न संस्थानों के वैज्ञानिकों को आंकडे संचय की पुनः प्राप्ति सेवा प्रदान करता है ।
- सभी सुविधाओं से युक्त आधुनिक पुस्तकालय है । इसमें 10,763 पुस्तकों, वैज्ञानिक जर्नलों के 6,962 सजिल्द खंडों और 80 जर्नलों का संचय है । इसके अतिरिक्त शोध निबंधों (292), शोध प्रबंधों (26) एवं तकनीकी प्रतिवेदनों (32) के संचयन का रखरखाव भी करता है। यह अपने सदस्यों को **सी डी रॉम** आँकडे संचय (**एग्रिस, बयोसिस, जैव प्रौद्योगिकी उद्धरण सूची, एकस्वकरण**) एवं **आँकड़े संचय** सुविधाएँ भी देता है ।

- **प्रकाशन :** कें रे अ प्र सं, रेशम उत्पादन संबंधी पुस्तकें, पुस्तिकाएँ, चौपन्ने और तकनीकी शोध-पत्र नियमित रूप से प्रकाशित करता है । प्रसिद्ध राष्ट्रीय एवं अंतर्राष्ट्रीय पत्रिकाओं में बहुत तकनीकी एवं शोध-पत्र प्रकाशित करने के अलावा अभी तक 35 से अधिक पुस्तकों का प्रकाशन भी किया गया है । संस्थान को अंतर्राष्ट्रीय ख्याति प्राप्त अर्धवार्षिक जर्नल "इंडियन जर्नल ऑफ सेरिकल्चर", रेशम उत्पादन विज्ञान संबंधी साहित्य को अभिलेखबद्ध करने वाला सेरिडॉक प्रकाशित करने का श्रेय प्राप्त है।

I. ABOUT CSR&TI, MYSORE

The Central Sericultural Research & Training Institute, Mysore was established under the aegis of Central Silk Board, Ministry of Textiles, Govt. of India and started functioning at Channapattana in the year 1961, after taking over the Sericulture Research Institute of erstwhile Mysore province. It was shifted to Mysore in the year 1963. With the inclusion of the training component, the Institute was renamed as – Central Sericultural Research & Training Institute (CSR&TI), Mysore in the year 1965. The Institute as on date has completed its 60 years of dedicated services for development of sericultural industry in the country. During December 2013, the Institute has been accredited with ISO 9001: 2008 certification as a testimony of excellence in quality management in R & D, training and service support to sericulture Industry.

Today, the Institute has the distinction of being the premier institution for sericulture research par excellence with all modern facilities and infrastructure. Over the decades, the Institute has grown in its stature, gained National and International repute. The Institute undertakes the entire gamut of sericultural R & D activities to cater to the needs of the on-farm sector of mulberry silk industry in Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra and Madhya Pradesh. With its well developed infrastructure and strong indigenously developed technological base, the Institute has made a mark as a leading R & D institution on tropical sericulture in the country and the institute is well recognized as a center for higher learning and advanced training on the international front. Its role in generating trained manpower has always been on high pedestals, both at domestic and international levels. So far, it has trained around 35000 persons in different aspects of sericulture science and technology including 749 foreign nationals. Besides conducting research, training and extension activities, the institute also offers consultancy and advisory services to national and international agencies.

Vision

To be a model organization for providing R & D services in sericulture for rural development and upliftment besides generation of human resources both at domestic and global level with special reference to tropical countries.

Mission

- To improve the productivity and quality of silk besides reducing the cost of production.
- To generate pro-environment, pro-poor and pro-women technologies for effective resource utilization.
- To develop low cost innovative technologies for overall improvement of socio-economic conditions of stakeholders.
- To undertake Human Resource Development at all levels of operation.
- To promote and popularize the cutting edge technologies in the field to increase production base of quality silk.

Mandate

- To develop mulberry sericultural technologies suitable to different agro-climatic conditions/zones.
- To conduct basic and applied research in various disciplines leading to the development of appropriate technologies.
- To test verify the proven technologies at field level for their adoptability.
- To conduct front-line & first-line demonstrations of developed technologies in the field.
- To conduct human resource development and training programmes.
- To serve as a testing centre for mulberry sericulture related rearing equipment, machines, products and technologies evolved in CSB institute or referred by other agencies.
- To coordinate with State Govts., voluntary organisations, NGOs, universities and other National institutes for collaborative research and technology transfer.

Organizational set-up

CSRTI, Mysore is the largest and most diversified institution engaged in sericulture R & D in the country, supported by about 150 scientists including Agricultural Engineers, Sociologists and Economists who are, working in close coordination for development of appropriate technologies and their transfer, both at the main institute and at the nested units spread over in the states of Karnataka, Tamil Nadu, Andhra Pradesh, Kerala, Maharashtra and Madhya Pradesh. The R & D activities and technology development are carried out in different disciplines under four major divisions: Host plant, Silkworm, Extension and Training. The Director monitors the progress of the R & D activities of the Institute and the nested units with the support of Planning, Monitoring, Coordination and Evaluation cell.

Extension network

To facilitate validation and effective translation of laboratory findings to the field, the Institute has a three-tier system of extension network – Regional Sericultural Research Stations (RSRS), Research Extension Centres (REC) and Sub-Units (SU). The RSRSs, located in major sericultural zones of the southern states carry out region specific adaptive and applied research. The technology trials are conducted to recommend the technologies suited to the regional requirements besides providing training to farmers and grass root level extension staff. The RECs and sub-units share the major responsibility of technology transfer to the beneficiaries and also provide all technological inputs to support them. Maintaining active collaborations with regional Agricultural Universities, the Institute is conducting video-conferencing sessions in Karnataka, Andhra Pradesh and Tamil Nadu for effective transfer of sericulture technologies. KIOSK installed at Farmers' Advisory Centre and the farmer's museum provides details of all technologies.

Training Centre

The institute is recognized as a flagship centre for generation of trained human resource in the field of tropical sericulture. It provides training in tropical sericulture both at international and

national level. The Institute is affiliated to University of Mysore for conducting research in Sericulture Technology & Bioinformatics including Ph.D. programmes in sericulture. It is also recognized by Dept. of Biotechnology and Dept. of Science & Technology, Govt. of India for conducting various training programmes, especially for socio-economic development and technological empowerment of the rural poor, weaker sections and women sericulturists. Besides catering to the HRD needs of the state departments of sericulture, the Institute is also conducting international sericulture training programmes.

The training wing houses well equipped classrooms with audio visual teaching aides and the programmes are managed by qualified faculty, recognized by various Universities. Hostels to accommodate about 125 persons are available.

Infrastructure facilities available

- Well-equipped laboratories, mulberry gardens and rearing houses to carry out advanced research in sericulture science.
- Large scale rearing houses for technology validation and farmers' training.
- Model chawki rearing centre (CRC) of 6,000 dfls capacity to promote the concept of CRC.
- Sericultural Engineering Division with excellent workshop facilities to support designing, development and fabrication of machines/equipment.
- State-of-art Biometric attendance system for employees.
- CSR&TI, Mysore in its endeavor to ensure faster communication and efficient transfer of technology from the lab to land, established a new Video Conference Studio with state-of-art technology, with which it has become easier to have effective interactions with nested units, DOS and other organizations.
- Computer center provides internet connectivity to all sections through local area network. The LAN also supports print/file sharing across the computers with ease.
- Bioinformatics Center established with the financial assistance of DBT under the National Bioinformatics Network, provides database retrieval service to the scientists of different institutions involved in Seri-biotechnology research in the southern states.
- A modern library with a collection of 10763 books, 6962 bound volumes of scientific journals and 80 journals. In addition, it also maintains a collection of dissertations (292), theses (26) and technical reports (32). It also provides CD-ROM database (AGRIS, BIOSIS, BIOTECHNOLOGY CITATION INDEX, EKASWA (Patenting) and DATABASE facilities to its members.
- CSRTI regularly publishes books, bulletins, leaflets and technical papers related to sericulture. Over 35 books have been brought out till date in addition to a large number of technical and research papers published in leading national and international journals. The institute has the distinction of publishing Indian Journal of Sericulture, a biannual journal of international repute, Seridoc - documenting literature on sericultural sciences.

II अप्रैल 2013 से मार्च 2014 तक की अवधि के अनुसंधान, प्रशिक्षण एवं विस्तारण कार्यकलापों के मुख्यांश

संस्थान तथा इसके सम्बद्ध एककों ने **57** अनुसंधान परियोजनाएं/कार्यक्रम कार्यान्वित किए है जिनमें से **8** को जैव प्रौद्योगिकी विभाग/विज्ञान एवं प्रौद्योगिकी विभाग/जा. अ स अ एवं आई आई एन आर जी से निधि प्रदत्त हुई । इस अवधि के दौरान **11** परियोजनाएं एवं **10** कार्यक्रम समाप्त हुए । रिपोर्टाधीन वर्ष के दौरान की मुख्य उपलब्धियाँ संक्षेप में नीचे प्रस्तुत हैं :

पोषी पादप सुधार, उत्पादन एवं संरक्षण :

- आर्द्रता प्रतिबल सहनशील उपजातियों के अंतिम उपज मूल्यांकन परीक्षण करने पर तीन जीनप्ररूप यथा एम एस जी-2 (मैसूर) एस एस जी-7 (चामराजनगर) एवं एम एस जी - 26 (अनंतपुर) ने मानक एस 13 से यथाक्रम 20.4, 17.23 एवं 35.51% अधिक उपज दी ।
- मूल विगलन एवं मूलगांठ प्रतिरोध शहतूत उपजातियाँ विकसित करने के लिए 7 संकरों के फलों से प्रतिरोधी प्राप्तियों को सम्मिलित कराते हुए संकर बीज बनाए गए और उच्च उत्पादक जीनप्ररूपों को पृथक करके बीज जीवन क्षमता एवं बीज अंकुरण के लिए परीक्षण किया गया 48 लक्षणों (आकृति, उत्पादक, शरीर क्रियात्मक एवं वृद्धि) के लिए डी यू एस किस्मों को अंतिम रूप दिया गया और किस्मों का परीक्षण करने हेतु शहतूत उपजातियों को पहचाना गया।
- एस.एस.आर. चिह्नक रेखाचित्रों एवं आकृति विशेषकों के आनुवंशिकी विविधता विश्लेषण के आधार पर 300 विविध जननद्रव्यों की तालिका का चयन किया गया । अधिकतम जननद्रव्य वैविध्य वाले 150 जननद्रव्यों से युक्त शहतूत कोर सब सेट विकसित किया गया ।
- दक्षिण राज्यों के 200 कृषकों के क्षेत्रों से मृदा एवं पत्ती प्रतिदर्शों का विश्लेषण कर तीन मुख्य घटकों यथा मृदा पी.एच्, मृदा जैव कार्बन एवं स्थूल घनत्व को पहचाना गया जो शहतूत में पोषण उद्ग्रहण को पर्याप्त प्रभावित करता है ।
- यूरिया के साथ नाइट्रीकरण निरोधकों का अनुप्रयोग किए जाने पर पौधों द्वारा पोषकों के उद्ग्रहण और मृदा में उपलब्ध पोषकों तथा पत्ती उपज में पर्याप्त वृद्धि दर्शाई गई । संस्थान तथा इसके क्षेत्रीय केंद्रों ने पणधारियों को मृदा परीक्षण सेवा प्रदान की । कुल 2086 मृदा प्रतिदर्शों का विश्लेषण किया गया और कृषकों को उचित उर्वरक सिफारिशें दी गई ।
- राइज़ाक्टोनिया बैटाटिकॉला द्वारा उत्पन्न शहतूत के मूलविगलन रोग का नियंत्रण / उन्मूलन करने हेतु विरोधी *वी. सेपेसिया, बी सटिलिस, स्यूडोमोनस एरूगिनोसा* के एक-एक प्रभेद युक्त अंत:पादपीय जैव नियंत्रण कारकों का टैल्क आधारित जैव सूत्रीकरण विकासित किया गया ।
- शहतूत के मूल गांठ रोग नियंत्रण हेतु विकसित नेमाहारी के क्षेत्र परीक्षण के अंतर्गत दक्षिण राज्यों से 10 कृषकों को लेकर दो परीक्षण पूरे किए गए । आंध्रप्रदेश, कर्नाटक एवं तमिलनाडु से ग्रीष्म वर्षा एवं शरत् ऋतुओं में एकत्रित 165 मृदा प्रतिदर्शों की जाँच की जाने पर लाभदायक एवं हानिकारक सूक्ष्माणुओं को दर्ज किया गया । सूक्ष्माणु जीव संख्या तथा ई.सी, ओ-सी, एन एवं के के बीच सकारात्मक समन्वयन पाया गया ।

- शहतूत रोगों के आधार पर आँकडा संचय विकसित करने हेतु पर्णीय रोग प्रकोप पर कैलेंडर तैयार किया गया और शहतूत रोगों से संबंधित एस.इ.एम. बिंबों को एकत्रित करके वेब पृष्ठ की अभिकल्पना की गई ।

रेशमकीट फसल सुधार, उत्पादन एवं संरक्षण :

- जैव प्रौद्योगिकी विभाग से निधि प्रदत्त परियोजना के अंतर्गत द्वि संकर कृष्णराजा को लोकप्रिय बनाने हेतु श्रीरंगपट्टणा ताल्लुक, मंड्या जिला के कृषकों को लेकर 11 परीक्षण संचालित किए गए । परीक्षण ने कोसा उपज में मानक सी.एस.आर 2 x सी.एस.आर.4 एवं पी.एम x सी.एस.आर.2 से यथाक्रम 19.97% एवं 5.27% वृद्धि दर्शाई । परिणामों ने श्रीरंगपट्टणा ताल्लुक के निकटस्थ 6 गाँवों के कृषकों को संकर नस्लों के स्थान पर द्वि संकरों को पालने हेतु प्रेरित किए ।
- प्राधिकरण उत्तर परीक्षण कार्यक्रम के अंतर्गत दक्षिण राज्यों में 1250 कृषकों के साथ सी.एस.आर.16 x सी.एस.आर.17 की 3.50 लाख रोग मुक्त बीज चकत्तों का परीक्षण किया गया । इस ने 64.2 कि.ग्रा./100 रो. मु. बी चकत्तों की औसतन उपज दर्शाई । दो चयनित त्रिपथ संकरों यथा एफ.सी 1 x सी.एस.आर2 एवं एफ.सी.3 x सी.एस.आर.17 का मानक संकरों के साथ तीन क्षे रे अ केंद्रों में मूल्यांकन किया गया जिससे साबित हुआ है कि ये संकर एकल संकर सी.एस.आर 2 x सी.एस.आर.4 से बेहतर है और द्वि संकर एफ.सी.1x एस.सी.2 के समतुल्य है ।
- दाता जनकों (ए पी एस 110 एवं एस के 4 सी) का उपयोग करते हुए एस एस आर चिह्नकों के सहारे ताप-सहनशीलता के लिए प्रजनन किया गया और ये वंश बी सी 3 पीढी के रहे । एन पी वी सहनशील द्विप्रज संकर विकसित करने हेतु बी एम एन ओ एक्स चिह्नकों के सहारे चयन किया गया और उच्च बी एस एन ओ एक्स प्रकट करने वाले 10 वंशों को विकसित किया गया।
- रिपोर्टाधीन वर्ष के दौरान आई सी बी, एल 14x सी एस आर 2 का क्षेत्र मूल्यांकन ज़ारी रहा। संकर चकत्तों को विकसित करने हेतु पी1 रोग मुक्त बीज चकत्तों का पालन करके बीज कोसे विकसित किए गए । 18 प्रतिबल सहनशील (एन पी वी एवं उच्च तापमान) बहुप्रज वंशों का बीच में मूल्यांकन कर आठ वंशों का चयन किया गया जो एफ-9 पीढी के हैं । संस्थान, क्षेरेअकें, कोडति, उ रे प्र कें, कूनूर एवं पी4 मू बी फा, हासन में बहु स्थानीय प्रजनन सिद्धांत के माध्यम से एल14 नस्ल विकसित किया गया । चार चक्र पूरा किया गया और संबंधित एककों में निम्नतम त्रिनिर्मोकियों, शीतनिष्क्रियता एवं एक समान कोसा रंग, आकृति एवं आकार युक्त वंशों का चयन किया गया ।
- कोर्डिसेप्स जो जैव चिकित्सा एवं औषध निर्माण के अनुप्रयोगों में उन्नत मूल्य का उत्पाद है, का संवर्धन करने की देशी विधि रेशमकीट प्यूपे में जीवे द्वारा और संवर्धन माध्यम में पात्रे चयन द्वारा विकसित की गई । प्रक्रिया के एकस्व हेतु आवेदन दायर किया गया है ।

- रेशमकीट बोंबिक्स मोरि में मध्यस्थ उपापचय को सुधारने हेतु शहतूत पत्ती की पोषण गुणवत्ता पर किए गए अध्ययन ने स्पष्टत: दर्शाया है कि शहतूत उपजाति वी.1 जो प्रोटीन (26.7%), कार्बोहाडड्रेट (17-6%) समृद्ध है, अधिक स्वस्थता एवं उपज लक्षण प्रदान करते है ।
- बीज उत्पादकों तथा वाणिज्यिक संकर पालकों के हित के लिए एल14 नस्ल एवं एल14 x सी एस आर 2 संकर हेतु कीटपालन प्रणाली विकसित की गई ।
- शहतूत बागान में भीम आफ्रिकन घोंघों का प्रबंधन करने हेतु 2 कि.ग्रा./एकड़ की दर से 2.5% मेटाल्डिहाइड पेल्लेट का अनुप्रयोग कर, हाथ से इक्ट्ठा कर और जलाकर या 25% लवण विलेय में डुबोकर नष्ट करने की सिफारिश की गई । जैव आमापन अध्ययन से साबित हुआ है कि मेटाल्डिहाइड रेशमकीटों के लिए सुरक्षित है ।
- मिश्रित फसल उपजातियों के निकटस्थ शहतूत क्षेत्रों में परभक्षी भ्रमर अधिक पाये जाते हैं तथापि अन्य फसलों के निकट उगाए गए शहतूत में पीड़क आपतन देखा गया ।
- कनकपुरा के उष्ण क्षेत्रों के शहतूत पौधों में विषाणु रोग दर्शाने वाले लक्षण पुष्ट किए गए ।
- चिक्काहारोहल्ली (श्रीरंगपट्टणा ताल्लकु) के अंगीकृत गाँवों में 631 फसलों के 78, 330 रोग मुक्त बीज चकत्तों में गैर रासायनिक प्रणाली (ऊजी ट्रैप की संस्थापना, 1584 एन थाइमस पाउच का विमोचन एवं रेशमकीट मल का पैकिंग/जलाना) कार्यान्वित किए जाने पर ऊजी प्रकोप 2% से कम हो गया ।
- कें रे अ प्र सं, परिसर में 84 पेटी भ्रमरों (21,000 वयस्क भ्रमर) एवं 266 ट्राइकों कार्डो का विमोचन किए जाने पर शहतूत पीड़क प्रकोप विशेषत: पिंक मीलीबग एवं लेपिडेप्टेरॉन पीड़क प्रकोप को 5% तक कम हो गया । इसके अलावा कें रे अ प्र सं परिसर के कीटपालनगृह में ऊजीट्रैप रखने के साथ-साथ 1038 पाउच एन. थाइमस परजीव्याओं को (103.8 लाख परिपक्व परजीव्याभ) विमोचित किए जाने पर ऊजी प्रकोप 2% तक कम हो गया ।
- दक्षिण राज्यों एवं महाराष्ट्र के विस्तारण कार्यकर्ताओं के माध्यम से 300 एकड़ शहतूत बागानों में टुकरा रोग नियंत्रण हेतु 74,250 परभक्षी भ्रमरों के विमोचन और ऊजीमक्खी के विरुद्ध 920 पाउच एम.थाइमस विमोचित कर 46000 रोग मुक्त बीज चकत्तों को लेकर रेशम उत्पादकों के बीच जैव नियंत्रण कारकों के उपयोग को लोकप्रिय बनाया गया ।
- नोसेमा बोम्बिसिस के एम ई टी ए पी 2 जीन को क्रमबद्ध किया गया और जातिवृत्तीय विश्लेषण करने पर मधुमक्खी से नोसेमा प्रजाति की समानता दर्शाई ।
- क्षेत्र सतर पर रोगों के कारण होने वाले रेशमकीट फसल नाश के लिए जिम्मेदार घटकों तथा कोसा उत्पादकता पर इसके प्रभाव को पहचानने हेतु तीन दक्षिण भारतीय राज्यों यथा कर्नाटक, आँध्रप्रदेश और तमिलनाडु में रेशमकीट रोगों पर सर्वेक्षण किया गया । मस्कार्डिन, ग्रैसरी एवं फ्लैचरी रोग प्रकोप 5% से कम रहा । उक्त अवधि के दौरान पेब्रिन रोग प्रकोप नहीं रहा ।

- माइक्रो-जेट का उपयोग करते हुए कीटपालन गृहों के विसंक्रमण हेतु नई प्रौद्योगिकी विकसित की गई । नई प्रौद्योगिकी रेशमकीटपालन में नीरसता कम करेंगी और विसंक्रामकों से बचाता है और कृषकों को रासायनिकों के संपर्क में आने से बचाता है ।
- प्रोबयोटिक बैक्टीरिया बैसील्लस साब्टिलिस को रेशमकीट बोक्बिक्स मोरि एल के रोगजनक जीवाणु बी थुरिंजिएन्सिस एवं स्ट्रेप्टोकोक्कस फीकालिस के विरुद्ध सक्रिय होते हुए पाया गया। इसी प्रकार रेशमकीट आंत्र से जीवाणु को पृथक किया गया जो बी.थुरिंजियेन्सिस के विरुद्ध सक्रिय साबित हुआ ।

रेशम उत्पादन विस्तारण :

- दक्षिण अँचल यथा कर्नाटक, आँध्रप्रदेश, तमिलनाडु, केरल, महाराष्ट्र एवं मंड्या के 106 समूहों में समूह संवर्धन कार्यक्रम कार्यान्वित किया गया । रिपोर्टाधीन वर्ष के दौरान समूहों के कृषकों को कुल 142.41 लाख रोग मुक्त बीज चकत्तें वितरित किए गए जिससे 68.31 कि.ग्रा./100 रोग मुक्त बीज चकत्तों की औसतन उपज देते हुए 8809 मी ट कोसे उत्पादित किए गए 1420 में ट का कुल कच्चा रेशम उत्पादित किया गया । 12,341 कृषकों के साथ 16515 एकडों में शहतूत पौध रोपण का विस्तार किया गया ।
- आई सी.बी. एल 14 x सी एस आर 2 के प्राधिकरण पूर्व क्षेत्र परीक्षणों के अंतर्गत दक्षिण राज्यों तथा महाराष्ट्र के क्षे रे अ केंद्रों /अ वि केंद्रों के 540 कृषकों के साथ कुल 1.59 लाख रो. मु.बीज चकत्तों का परीक्षण किया गया और 51.75 कि.ग्रा./100 रो मु बीज चकत्तों की औसतन उपज दर्ज की गई । इसके अतिरिक्त पी.एम x सी.एस.आर.2 के 32,603 रो मु बी चकत्तों को 90 कृषकों को वितरित किया गया जिस से 56.9 कि.ग्रा/100 रो मु बी च की उपज प्राप्त हुई। संस्थान के मॉडल चॉकी कीटपालन केंद्र में 35 सत्रों में 85650 रो मु बी चकत्तों का झाडन कर अंगीकृत किसानों को चॉकी कीट वितरित किए गए और 67.71 कि.ग्रा./100 रो मु बी चकत्ते प्राप्त हुए ।
- संस्थान में दिनांक 13 दिसंबर 2013 को "द्विप्रज रेशम उत्पादन में चॉकी कीटपालन केंद्रों की भूमिका" पर कार्यशाला आयोजित की गई जिसमें दक्षिण राज्यों के चॉकी कीटपालन केंद्रों के मालिकों, समूह संवर्धन सुसाध्यकों तथा रेशम उत्पादन विभाग पदधारियों ने भाग लिया । इसके अतिरिक्त 28 जनवरी 2014 को "स्थायी आजीविका के लिए रेशम उत्पादन" पर कृषक कार्यशाला आयोजित की गई जिसमें रेशम उत्पादन विभाग के पदधारियों तथा निजी उद्यमियों सहित कर्नाटक के 30 जिलों का प्रतिनिधित्व करने वाले 1863 कृषकों ने भाग लिया ।

- रिपोर्टाधीन वर्ष के दौरान संस्थान तथा इसके संबद्ध एककों द्वारा 272 सामूहिक चर्चाएँ, 35 फिल्म प्रदर्शनियाँ, 108 जागरूकता कार्यक्रम, 87 क्षेत्र दिवस, 65 प्रदर्शनियाँ, 29 एक्सिबिशन, 32 उद्बोधन कार्यक्रम, 26 प्रभावन/अध्ययन दौरे, 3 कार्यशालाएँ, 3 कृषकों की बैठक /कृषिमेला आयोजित की गई जिसके माध्यम से 30969 रेशम उत्पादकों को मुख्यत:

द्विप्रज कीटपालन, शहतूत, रेशमकीट रोग प्रबंधन एवं गुणात्मक कोसा उत्पादन की नई प्रौद्योगिकियों से अवगत किया ।

- कें रे अ प्र सं, मैसूर एक ऐसा आकर्षक केंद्र भी है जहाँ से रेशम उत्पादन कृषकों, छात्रों तथा अन्य आगंतुकों को रेशम उत्पादन प्रौद्योगिकियों पर प्राथमिक सूचना मिलती है । रिपोर्टाधीन वर्ष के दौरान 2395 छात्रों, तथा 149 विदेशियों के अतिरिक्त देश के विभिन्न भागों से 5416 कृषकों ने संस्थान का वीक्षण किया ।
- कर्नाटक, आँध्रप्रदेश एवं तमिलनाडु के रेशम उत्पादन कृषकों द्वारा पीड़क एवं रोग प्रबंधन कार्यनीतियाँ अपनाने के संबंध में 300 कृषकों से एकत्रित अँकडें से यह साबित हुआ है कि कर्नाटक के 95% कृषक शहतूत रोग नियंत्रण उपायों से अवगत है । अपनाने का स्तर यांत्रिक उपायों में अधिक (73% रोग एवं 61% पीड़क) पाया गया । जिसके अनुसरण में रासायनिक (70% रोग एवं 57% पीड़क) और जैव विधि (32% रोग एवं पीड़क) है तथापि शहतूत पीड़कों के बारे में जागरूकता 56% ही रही । इसमें मुख्य बाधाएँ थी, जैव नियंत्रण कारकों का समय पर और पास में उपलब्ध न होना, पर्याप्त रोकथाम उपायों का न होना एवं रोग नियंत्रण उपायों की विलंब से कार्रवाई ।

मानव संसाधन विकास

- वस्त्र मंत्रालय, भारत सरकार की एकीकृत कुशलता विकास योजना (ए कु वि यो) के अंतर्गत 27 बैंचों में कुल 518 लाभार्थियों को चार विषयों पर यथा कोसा हस्तशिल्प, शहतूत कृषि एवं इसका बीज गुणन, गुणात्मक द्विप्रज कोसा उत्पादन एवं चॉकी कीटपालन पर प्रशिक्षित किया गया ।
- इसके अलावा कें रे अ प्र सं, मैसूर एवं संबद्ध एककों में संरचित एवं आवश्यकता आधारित कार्यक्रमों के अंतर्गत कुल 1539 व्यक्तियों को प्रशिक्षित किया गया । इसके अतिरिक्त नए सी.एस.बी. बीज अधिनियम के अंतर्गत 37 चॉकी कीटपालन केंद्र के मालिकों को तीन बैचों में तीन महीने की अवधि के लिए वाणिज्यिक चॉकी कीटपालन पर प्रशिक्षित किया गया ।
- समूह संवर्धन कार्यक्रम के प्रभावी कार्यान्वयन हेतु 192 समूह सुसाध्यकों के लिए चार बैचों में अभिविन्यास प्रशिक्षण कार्यक्रम आयोजित किया गया ।
- बंगलादेश और अफगानिस्तान के 21 पदधारियों हेतु क्रमशः 33 एवं 10 दिनों के लिए अंतर्राष्ट्रीय प्रशिक्षण कार्यक्रम आयोजित किया गया ।

एकस्व एवं वाणिज्यीकरण

- कोसा फसल संग्राहक, रेशम कक्ष तापक, चॉकी झाडन यंत्र, पी वी सी चॉकी मंच, जल जेट तंत्र आदि यंत्र सामग्रियों के लिए एकस्व दायर किया गया और स्पेन्ट शलभों का उपयोग करने तथा कोर्डिसेप्स का संवर्धन करने के एकस्वीकरण पर कार्रवाई हो रही है । आगे, कोसा फसल संग्राहक और रेशम कक्ष तापक को सर्वश्री राज एन्टरप्राइज़ेस, मैसूर के माध्यम से वाणिज्यीकृत किया गया ।

प्रकाशन :

- 62 शोध पत्रों, 09 लोकप्रिय लेखों को मिलाकर कुल 258 अनुसंधान प्रकाशनों को राष्ट्रीय एवं अंतर्राष्ट्रीय पत्रिकाओं में प्रकाशित किया गया । इसके अतिरिक्त 2 पुस्तकें, 5 पुस्तिकाएँ/ तकनीकी बुलेटिने, 43 न्यूज़/ रिपोर्ट/रेशम संक्षेप, 50 विस्तारण पुस्तिकाएँ /विवरणिकाएँ/ चौपन्ने भी प्रकाशित किए गए । संगोष्ठियाँ/कार्यशालाएँ/सम्मेलनों में 87 शोध पत्र प्रस्तुत किए गए ।

- वर्ष 2012-13 की वार्षिक रिपोर्ट के अतिरिक्त इन्डियन जर्नल ऑफ सेरिकल्चर, सेरिडॉक और रेशम किरण (हिन्दी) प्रत्येक के दो अंक प्रकाशित किए गए ।

क्षेत्रीय रेशम उत्पादन अनुसंधान केंद्र की उपलब्धियाँ :

क्षेत्रीय रेशम उत्पादन अनुसंधान केंद्र, अनंतपुर

अर्धशुष्क कृषि जलवायु स्थितियों के अधीन पाँच श्रेष्ठ शहतूत उपजातियाँ (जी 2, आर सी 1, आर सी 2, ताईवान, वी-1 एवं अनंता) रही । दो फसलों के लिए परीक्षणाधीन उपजातियों की उपज एवं वृद्धि आँकडे एकत्रित किए गए जिसमें से वी-1 की 21.2 कि.ग्रा. और अनंता की 19.4 कि.ग्रा की तुलना में जी-2 ने 26.4 कि.ग्रा की उच्चतम उपज दर्ज की ।

- दो त्रिपथ संकरों (एफ सी 3 x सी एस आर 17, एफ सी1 x सी एस आर 2) एकल संकर (2 सी x 4 एस) और द्वि संकर (जी11 x जी 19) के साथ क्षेत्र परीक्षण किए गए । परिणामों ने दर्शाया कि कोसा एवं कोसोत्तर लक्षणों में परीक्षण संकरों ने मानकों से बेहतर निष्पादन किया ।
- ऊजी मुक्खी के प्रभावी प्रबंधन हेतु 656 थैली एन थाइमस उत्पादित कर क्षेत्र में आपूर्तित किया गया । उष्ण क्षेत्रों में नवीन्या का अनुप्रयोग कर मूल विगलन रोग नियंत्रित करने हेतु आवश्यकता आधारित प्रौद्योगिकी प्रदर्शन किया गया ।
- प्राधिकरण उत्तर परीक्षण कार्यक्रम के अंतर्गत उन्नत द्विप्रज संकरों की 1,48,000 रो मु बी चकत्तों (सी एस आर 16 x सी एस आर 17, सी एस आर 46 x सी एस आर 47, जेन 3 x जेन 2 और ए पी एस 45 x एपी एस 12) को 200 कृषकों को वितरित किया गया और 62.78 कि.ग्रा./100 रो मु बी च की औसतन उपज प्राप्त हुई । आगे आई सी बी एल 14 x सी एस आर 2 को लोकप्रिय बनाने के अंतर्गत कुल 31,700 रो मु बी चकत्तों को 40 फसलों में 150 कृषकों को वितरित किए गए । 50.68 कि.ग्रा/100 रो मु बी च की औसतन कोसा उपज प्राप्त हुई ।
- ए कु वि यो के अंतर्गत में 105 बेरोज़गार महिलाओं और युवाओं को प्रशिक्षित किया गया और प्रौद्योगिकी/उन्नयन कार्यक्रम के अधीन 59 कार्यक्रमों में 885 कृषकों को प्रशिक्षित किया गया ।
- 240 विस्तारण संचार कार्यक्रमों के माध्यम से कुल 560 कृषक प्रभावित हुए ।

- दो रेशम उत्पादन कृषक कार्यशाला आयोजित की गई जिसमें 650 कृषकों को रेशम उत्पादन की आधुनिक प्रौद्योगियों और द्विप्रज कीटपालन तकनीकों में प्रशिक्षित किया गया ।

क्षेत्रीय रेशम उत्पादन अनुसंधान केंद्र, चामराजनगर

शहतूत पौधारोपण में लाक उत्पादन की व्यवहार्यता पर अध्ययन करने हेतु आय वृद्धि के लिए सेरि-लाक संवर्धन नमूना विकसित करने का कार्य किया गया । लाक कीट को संरोपित करने हेतु शहतूत वृक्षों के बीच फ्लेमंगिया पादपों को लगाया गया और संरक्षी सिंचाई हेतु ड्रम किट लगाया गया है ।

- कृषक स्तर पर क्षेत्र परीक्षण द्वारा जल प्रतिबल स्थिति के अधीन आर.सी 1 एवं आर.सी.2 उपजातियों का मूल्यांकन किए जाने पर साबित हुआ है कि ये उपजातियाँ जल प्रतिबल स्थिति के लिए उपयुक्त है । कृषक स्तर पर ए आर 12 उपजाति का परीक्षण किए जाने पर साबित हुआ है कि ए आर 12, सिंचित स्थितियों के अधीन क्षारीय मृदा के लिए उपयुक्त है ।
- एकीकृत पोषण प्रबंधन परीक्षण से पाया गया है कि पत्ती गुणवत्ता और उपज में 9% वृद्धि हुई है। जल प्रतिबल क्षेत्रों में वृक्ष रोपण हेतु उचित प्रणालियाँ विकसित करने के लिए शहतूत वृक्ष रोपण का मूल्यांकन किया गया । सिंचित स्थिति के अधीन क्षेत्र में स्थायी शहतूत पत्ती उत्पादन हेतु जैव कृषि का मूल्यांकन किया गया जिससे पत्ती उपज में 5.32% वृद्धि हुई ।
- त्रिपथ संकर एफ सी 1 x सी एस आर 2 एवं एफ सी 3 x सी एस आर 17 के क्षेत्र परीक्षण ने मानक संकरों से अधिक उत्तरजीविता और उपज दर्शाई ।
- क्षेत्र स्तर पर 104 थैली एन.थाइमस उत्पादित कर विमोचित किए जाने पर ऊजी प्रकोप 14.11% से 6.27% कम हुआ । क्षेत्र स्तर पर 32 बक्से लेडि बर्ड भ्रमरों (सी. मोंट्रोज़ीरि/ एस कोक्सिवोरा) विमोचित किए जाने पर मीली बग प्रकोप 20.67% से 6.83% तक कम हुआ।
- ए कु वि यो के अंतर्गत 3 बैचों में कुल 60 कृषकों तथा आवश्यकता आधारित कार्यक्रमों के अंतर्गत 180 कृषकों को प्रशिक्षित किया गया । आगे, 35 विस्तार संचार कार्यक्रमों से 3350 कृषक लाभान्वित हुए ।

क्षेत्रीय रेशम उत्पादन अनुसंधान केंद्र, कोडति

- शहतूत उपजातियाँ आर सी 1 और आर सी 2 पर केंद्र परीक्षण किए गए । मूल विगलन प्रबंधन के लिए नवीन्या और शहतूत में आई एन एम का प्रयोग किया गया । आगे दो त्रिपथ संकरों (एफ सी 3 x सी एस आर 17, एफ सी 1 x सी एस आर 2) एकल संकर (2 सी x 4 एस) और द्वि संकर (जी 11 x जी 19 ; डी 1 x डी 2 ; डी 2 xडी 3) और बहु x द्वि संकर (एन डी वी 6 xसी एस आर 51; एल 14 x सी एस आर 50) का परीक्षण किया

गया। परिणामों ने अधिक कोसा एवं कोसोत्तर लक्षणों के संदर्भ में मानकों की अपेक्षा परीक्षण संकरों की श्रेष्ठता साबित की ।

- रिपोर्टाधीन वर्ष के दौरान 549 मृदा प्रतिदर्शों का विश्लेषण किया गया और उचित मृदा सुधार उपाय सुझाए गए ।
- प्राधिकरण उत्तर कार्यक्रम के अंतर्गत केंद्र तथा अनुसंधान विस्तारण केंद्रों द्वारा 178 कृषकों को सी एस आर16 x सी एस आर 17, सी एस आर 46 x सी एस आर 47, जेन 3 x जेन 2 और ए पी एस45 x एपी एस 12 के कुल 44,225 रो मु बी चकत्तें वितरित किए गए और 62.83 कि.ग्रा/100 रो मु बी चकत्तों की औसतन उपज दर्ज की गई । आगे एल14 x सी एस आर 2 के 42,700 रोग मुक्त बीज चकत्तों को वितरित किया गया जिससे 56.8 कि.ग्रा/100 रो मु बी च की उपज प्राप्त हुई ।
- क्षे रे अ कें एवं संबद्ध एककों द्वारा 218 कृषकों को टुकरा एवं ऊजी के लिए ए पो प्र, ए पी प्र वानस्पतिक खाद मूल विगलन रोग के लिए नवीन्या आदि प्रौद्योगिकियों का प्रदर्शन किया गया ।
- ए कु वि यो के अंतर्गत 4 बैचों में 75 कार्मिकों तथा प्रौद्योगिकी उन्नयन के अंतर्गत 65 कार्यक्रमों में 975 कृषकों को प्रशिक्षण दिया गया । क्षे रे अ कें एवं संबद्ध एककों द्वारा कुल 139 कार्यक्रम आयोजित किए गए और 5065 कृषकों ने सक्रिय रूप से भाग लिया।

क्षेत्रीय रेशम उत्पादन अनुसंधान केंद्र, सेलम

- दो त्रिपथ संकरों (एफ सी 3x सी एस आर 17, एफ सी 1 x सी एस आर 2), एकल संकर (2 सी x 4 एस) और द्वि संकरों (डी 1 x डी 2, डी 2 x डी3) और बहु x द्वि संकरों (एन डी वी-6x सी एस आर 51 : एल 14 x सी एस आर 50) का क्षेत्र परीक्षण किया गया । परिणामों से साबित हुआ है कि अधिक कोसा एवं कोसोत्तर लक्षणों की दृष्टि में परीक्षण संकर मानक से श्रेष्ठ है ।
- रिपोर्टाधीन अवधि के दौरान 94 मृदा प्रतिदर्शों का विश्लेषण किया गया और उचित मृदा सुधार उपाय सुझाए गए ।
- पपीता मीलीबग का नाश कम करने हेतु एसेरोफैगस पपाये के 933 यूनिट (233250 नग) का व्यापक गुणन किया गया और संक्रमित शहतूत बागानों में विमोचित किया गया ।
- क्षे रे अ कें, सेलम एवं इसके संबद्ध एककों द्वारा संचालित विभिन्न विस्तार संचार कार्यक्रमों के माध्यम से कुल 14,990 पणधारियों को प्रोत्साहन मिला ।
- एकीकृत कुशलता विकास योजना के अंतर्गत 105 लाभार्थियों को स्वयं आजीविका कमाने के लिए अपनी कुशलता बढ़ाने हेतु प्रशिक्षित किया गया । प्रौद्योगिकी उन्नयन कार्यक्रम के अंतर्गत 82 बैंचों में 1230 कृषकों को प्रशिक्षण दिया गया ।
- यह अनुसंधान केंद्र पेरियार विश्वविद्यालय, सेलम के अधीन वनस्पति विज्ञान और रेशम उत्पादन में उच्च अध्ययन करने के केंद्र के रूप में कार्यरत है जिसके तहत 8 छात्रों को पी एच.डी प्रदान किया गया और 10 छात्र शोध कार्य कर रहे हैं ।

III.परिणाम ढांचा दस्तावेज (आरएफडी) 2013-14 के महत्वपूर्ण घटकों पर हुई उपलब्धियों के मुख्यांश

क्र सं	कार्रवाई	एकक	लक्ष्य	प्राप्ति	प्राप्ति %
1	चलाई गई परियोजनाएं	सं.	05	08	160
2	समाप्त परियोजनाएं	सं.	10	11	110
3	विकसित उन्नत शहतूत प्रजातियाँ	सं.	02	03	150
4	उपजातियों को क्षेत्र में समावेशन	सं.	03	03	100
5	विकसित उन्नत द्विप्रज संकर	सं.	03	03	100
6	विकसित उन्नत तीसरी पीढ़ी के संकर	सं.	01	01	100
7	क्षेत्र में नस्लों का समावेशन	सं.	03	03	100
8	प्रौद्योगिकियों का समावेशन	सं.	02	07	350
9	मशीनों/उपस्करों का समावेशन	सं.	02	04	200
10	पैकेजों का समावेशन	सं.	02	09	450
11	वाणिज्यिकृत प्रौद्योगिकियाँ	सं.	03	07	233
12	एकस्व करने हेतु ली गई प्रौद्योगिकियाँ	सं.	02	07	350
13	प्रेरित पणधारी	सं.	20000	30969	155
14	सम्मिलित समूह	सं.	95	107	113
15	सम्मिलित लाभार्थी	सं.	19000	23094	122
16	उन्नत शहतूत उपजातियों सहित नया पौधारोपण	एकड़	130	1578.3	1214
17	क्षेत्र समस्याओं पर विचार	सं.	12	17	142
18	समूहों में क्षेत्र समस्याओं का समाधान	सं.	01	15	1500
19	वशवर्ती क्षेत्रों के माध्यम से द्विप्रज कच्चा रेशम उत्पादन	मि ट	1400	1402	100
20	जो क्षेत्र अधीन में नहीं है उनके माध्यम से द्विप्रज कच्चा रेशम उत्पादन	मि ट	110	120	109
21	आई.सी.बी कच्चा रेशम उत्पादन	मि ट	2100	2150	102
22	एकीकृत कुशलता विकास योजना के अंतर्गत प्रशिक्षित पणधारी	सं.	310	518	167
23	अन्य कार्यक्रमों में प्रशिक्षित पणधारी	सं.	4250	4831	114
24	आपूर्तित मूल बीजों के रोग मुक्त बीज चकत्ते	सं.	18000	26167	145
25	अनुसंधान लेखों का प्रकाशन	सं.	22	46	209
26	विस्तारण बुलेटिनों का प्रकाशन	सं.	12	32	267
27	वैज्ञानिक पत्रिकाओं का प्रकाशन	सं.	04	06	150
28	पीड़कों एवं रोगों का पूर्वानुमान एवं पूर्वसूचना	सं.	13	30	231
29	सहयोगी परियोजनाएँ	सं.	02	03	150

II. HIGHLIGHTS OF RESEARCH, TRAINING AND EXTENSION ACTIVITIES DURING APRIL 2013 TO MARCH 2014

- The Institute and its nested units implemented **57** research projects/programmes, of which **8** were funded by DBT/DST/JICA/IINRG. During the period, **11** projects and **10** programmes were concluded. The major achievements during the year are presented below in brief.

HOST PLANT IMPROVEMENT, PRODUCTION AND PROTECTION

- Under final yield evaluation trials of moisture stress tolerant varieties undertaken, three genotypes, *viz.,* MSG-2 (Mysore), MSG-7 (Chamarajanagar) and MSG-26 (Anantapur) out yielded the check, S13 by 20.4, 17.23 and 35.5% respectively.

- Towards developing root rot and root knot resistant mulberry varieties, hybrid seeds from the fruits of 7 crosses made involving resistant accessions and high yielding genotypes were isolated and tested for seed viability and seed germination. The DUS descriptors for 48 characters (morphological, reproductive, anatomical & growth) have been finalized and mulberry varieties for testing the descriptors have been identified.

- A panel of 300 diverse germplasm has been identified based on genetic diversity analysis of SSR marker profiles and morphological traits. A core sub-set of mulberry comprising of 150 germplasm containing maximum genetic diversity has been developed.

- Soil and leaf samples from 200 farmers' fields in southern states were analyzed and three major factors, *viz.,* soil pH, soil organic carbon and bulk density were identified which significantly influenced nutrient uptake in mulberry.

- Application of nitrification inhibitors along with Urea showed significant improvement in the uptake of nutrients by plants and available nutrients in soil and leaf yield. The Institute and its regional stations have offered soil testing services to the stakeholders. A total of 2086 soil samples were analyzed and suitable fertilizer recommendations were provided to the farmers.

- A talc based bioformulation of endophytic bacterial biocontrol agents comprising of one strain each of antagonistic *B. cepacia, B. subtilus* & *P. aerugunosa* has been developed for the control/suppression of root rot disease of mulberry caused by *Rhizoctonia bataticola.*

- Under OFT of Nemahari, a plant based formulation for control of root knot disease of mulberry, two trials were completed with 10 farmers each at southern states. Beneficial & harmful microbes were recorded through screening of 165 soil samples collected from AP, KA and TN during summer, rainy and winter seasons. Positive correlation was found between microbial population and EC, OC, N and K.

- For developing a database on mulberry diseases, calendars on the occurrence of foliar diseases were prepared and SEM images related to mulberry diseases were collected and the Web page has been designed.

SILKWORM CROP IMPROVEMENT, PRODUCTION AND PROTECTION

- Under the DST funded project, popularisation of the double hybrid, Krishnaraja under 11 trials was conducted with farmers of Srirangapatna Taluk, Mandya Dist, which showed an improvement of 19.97% and 5.27 % in the cocoon yield over the controls, CSR2 x CSR4 and PM x CSR2 respectively. The results have motivated the farmers of six adjacent villages in Srirangapatna Taluk for rearing double hybrids in place of cross breeds.

- Under the PAT programme, 3.50 lakh dfls of CSR16 x CSR17 were tested in southern states with 1250 farmers which showed an average yield of 64.2 kg/100 dfls. Two selected three way cross hybrids; FC1 x CSR2 and FC3 x CSR17 were evaluated along with control hybrids at three RSRSs which showed that these hybrids are better than single hybrid CSR2 x CSR4 and on par with double hybrid FC1 x FC2.

- Breeding for thermo-tolerance has been taken up employing the SSR marker assisted selection using the donor parents (APS110 and SK4C) and the lines are at BC3 generation. For developing NPV tolerant bivoltine breeds, BmNOX marker assisted selection was undertaken and 10 lines with high BmNOX expression have been developed.

- Field evaluation of ICB, L14 x CSR2 was continued during the year. P1 dfls were reared and seed cocoons were generated for raising hybrid layings. Midway evaluation of 18 stress tolerant (NPV and high temperature) polyvoltine lines was conducted and eight lines have been short-listed which are in F9 generation. Improvement of L14 breed through multi-locational breeding approach was simultaneously carried out at the Institute, RSRS, Kodathi, SSBS, Coonoor and P4 BSF, Hassan. Four cycles were completed and lines with least trimoulters and hibernation as well as with uniform cocoon colour, shape and size have been selected in the respective units.

- Indigenous method of culturing *Cordyceps*, which is a high value product for biomedical and pharmaceutical applications, was developed both *in vivo* on silkworm pupa and *in vitro* on culture media. Patent for the process has been filed.

- Studies on nutritional quality of mulberry leaf for improvement intermediary metabolism of silkworm *Bombyx mori* clearly showed that, the mulberry variety V1 which is rich in protein (26.7%), carbohydrates (17.6%), was found to significantly contribute to higher fitness and yield traits.

- A rearing package for L14 breed and L14 x CSR2 hybrid was developed for the benefit of the seed rearers as well as commercial hybrid rearers.

- Application of 2.5% Metaldehyde pellets @2kg/acre coupled with manual collection and destruction by burning or dipping in 25% salt solution was recommended for the management of giant African snails in mulberry garden. Bioassay studies revealed that Metaldehyde is safe to silkworms.

- Recovery of predatory beetles was found to be highest with mulberry in the vicinity of mixed crop species. However, pest incidence did not vary significantly in mulberry grown in the vicinity of other crops.

- Systemic nature of symptoms was confirmed in mulberry plants showing viral type expressions in hot spot area of Kanakapura.

- In an adopted village of Chikkaharohalli (Srirangapatna Taluk) implementation of non-chemical package (placement of uzi trap, release of 1,584 *N. thymus* pouches and packing/burying of silkworm litter) covering 78,330 DFLs of 631 crops was able to maintain uzi fly infestation consistently below 2%.

- Release of 84 boxes of beetles (21,000 adult beetles) and 266 Tricho cards in CSRTI campus was successful in keeping mulberry pest incidence especially pink mealy bug and lepidopteron pests below 5%. Besides, 1038 (103.8 lakhs adult parasitoids) pouches of *N. thymus* parasitoids coupled with placement of uzi traps in rearing houses at CSRTI campus was able to keep uzi infestation below 2%.

- Popularized the use of bio-control agents among sericulturists by covering about 300 acres of mulberry gardens through release of 74,250 predatory beetles for control of tukra and about 46,000 DFLs for release of 920 pouches of *N. thymus* against uzi fly through extension functionaries of southern states and Maharashtra.

- The MetAP2 gene of *Nosema bombycis* was sequenced and the phylogenetic analysis showed similarity to *Nosema sp*. of honey bee.

- Surveys on Silkworm diseases has been carried out in three South Indian states *viz.,* Karnataka, Andhra Pradesh and Tamil Nadu for identification of factors responsible for silkworm crop loss due to diseases at field level and its impact on cocoon productivity. Incidence of muscardine, grasserie and flacherie were below 5%. There was no incidence of pebrine disease during this period.

- A new technology for disinfection of rearing sheds using micro-jets was fine tuned. The new technology will reduce drudgery in silkworm rearing, saves the disinfectants and avoid exposure of farmers to chemicals.

- A known probiotic bacteria *Bacillus subtilis* found to have antagonistic activity against pathogenic bacteria, *B. thuringiensis* and *Streptococcus faecalis* of silkworm *Bombyx mori* L. Simultaneously a bacterium from silkworm gut which proved to be antagonistic against *B. thuringiensis* was isolated.

SERICULTURE EXTENSION

- The Cluster Promotion Programme (CPP) is implemented in Southern zone *viz.,* Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra and Madhya in 106 clusters. During the year, a total of 142.41 lakh DFLs were distributed to the farmers of the clusters, where 8809 MT of cocoons were produced with an average yield of 68.31 kg for 100 DFLs leading to a total raw silk production of 1420 MT. Mulberry plantation was expanded by 16,515 acres with 12,341 farmers.

- Under Pre authorization field trials of ICB, L14 x CSR2, a total of 1. 59 lakh dfls were tested with 540 farmers of RSRS/RECs of southern states and Maharashtra and recorded an average cocoon yield of 51.75 kg/100 dfls. Further, 32,603 dfls of PMxCSR2 were also distributed to 90 farmers where the yield was found to be 56.9 kg/100 dfls. Model CRC at the Institute undertook brushing of 85,650 dfls in 35 batches and distributed the chawki worms to adopted farmers and the an average yield of 67.71 kg/100 dfls was realized.

- A workshop on the “Role of CRCs in bivoltine silk production” was organized on 13th December 2013 at the Institute in which the owners of CRCs, CDFs and DoS officials of southern states participated. Further, a farmers workshop on “Sericulture for sustainable livelihood“ was also organized on 28th January 2014 in which 1863 farmers representing all the 30 districts of Karnataka state participated, along with DoS officials and private entrepreneurs.

- During the year, 272 Group Discussions, 35 Film Shows, 108 Awareness Programme, 87 Field days, 65 Demonstrations, 29 Exhibition, 32 Enlightenment programme, 26 Exposure visit/ Study Tours, 3 Workshops, 3 Farmers Meet / Krishimelas were conducted by the institute and its nested units, sensitising 30,969 sericulturists mainly on the new technologies for bivoltine rearing, mulberry, silkworm disease management and quality cocoon production.

- CSRTI, Mysore is also centre of attraction for sericulture farmers, students and other visitors to get a first hand information on new sericulture technologies. During the period a total of 5416 farmers from different parts of the country, besides 2395 students and 149 foreigners visited the institute.

- The data collected from 300 farmers on extent of adoption of pest and disease management strategies by the sericulture farmers in Karnataka, Andhra Pradesh and Tamil Nadu, indicates that 95% of the farmers from Karnataka are aware of the mulberry disease control measures. The adoption level was found to be higher in mechanical measures (73% disease and 61% pest) followed by chemical (70% disease and 57% pest) and biological method (32% disease and pest). However, awareness about mulberry pests was found only 56%.The major constraints for adoption were availability of bio-control agents in time and in close proximity, in adequate preventive and delayed action for disease control measures.

HUMAN RESOURCE DEVELOPMENT

- Under Integrated Skill Development Scheme (ISDS) of Ministry of Textiles, Govt. of India, a total of 518 beneficiaries were trained in 27 batches on four subjects’ *viz.,* Cocoon handicraft, Mulberry cultivation and its seed multiplication, Quality bivoltine cocoon production and Chawki rearing.

- Besides, a total of 1539 persons were trained under structured and need based programmes at CSRTI, Mysore and nested units. In addition, 37 CRC owners were trained in three batches for a period of 3 months on commercial chawki rearing under the new CSB seed act.

- Four batches of orientation training programme were organized for 192 Cluster facilitators for effective implementation of Cluster Promotion Programme.

- An International Training programme of 33 days and 10 days for 21 officials each from Bangladesh and Afghanistan respectively was organized.

PATENTS AND COMMERCIALISATION

- Patents were filed for machineries like cocoon harvester, seri room heater, chawki dusting machine, PVC chawki stands, water jetting system and also processes for using spent moths and culturing *Cordyceps*. Further, cocoon harvester and seri room heater were commercialized through M/S. Raj Enterprises, Mysore.

PUBLICATION

- A total of 258 research publications including 62 research papaers, 09 popular articles were published in the journals of national and international repute. In addition, 2 books 5 booklets/Technical bulletins, 43 news/reports/silk briefs, 50 extension manuals/ brouchers/pamphlets were also published. Further 87 research papers were presented in seminars/workshops/conferences.
- Two issues each of Indain Journal of Sericulture, Seridoc and Resham Kiran (Hindi) were published in addition to the annual report of 2012-13.

ACHIEVEMENTS OF REGIONAL RESEARCH STATIONS (RSRSs)

RSRS, ANANTAPUR

- Five elite mulberry varieties (G2, RC1, RC2, Taiwan, V1 & Anantha) were under semi-arid agro-climatic conditions. Yield & growth data of the test varieties, were collected for two crops, which recorded highest yield of 26.4 kg in G2, compared to 21.2 kg in V1 and 19.4 kg in Anantha.
- On-Station Trials (OSTs) was undertaken with two three-way cross hybrids (FC3 x CSR17, FC1 x CSR2), single hybrid (2C x 4S) and double hybrid (G11 x G19). The results showed that the test hybrids performed better than the controls with respect to cocoon and post-cocoon traits.
- A total of 656 sachets of *N. thymus* were produced and supplied in the field for effective management of uzi fly. Need based technology demonstrations to control root rot disease by application of Navinya were conducted in hot spot areas.
- Under PAT programme, 1,48,000 dfls of improved bivoltine hybrids (CSR16 x CSR17, CSR46 x CSR47, GEN3 x GEN2 and APS45 x APS12) were distributed to 200 farmers and obtained an average cocoon yield of 62.78 kg / 100 dfls. Further, under the popularization of ICB, L14 x CSR2, a total of 31,700 dfls were distributed to 150 farmers in 40 crops. An average cocoon yield of 50.68 kg / 100 dfls was achieved.
- Under ISDS, 105 unemployed women and youth were trained and 885 farmers in 59 programmes under Technology Up-gradation Programme were covered.
- A total of 560 farmers were sensitized through 240 Extension Communication Programmes.
- Two Sericulture farmers' Workshops were conducted covering 650 farmers who were educated in recent technologies of sericulture and bivoltine rearing techniques.

RSRS, CHAMARAJANAGAR

- Development of Seri-Lac culture model for income augmentation was carried out to study the feasibility of lac production in mulberry plantation. Flemingia seedlings were transplanted in between mulberry tree plantation for inoculation of Lac insect and Drum kit has been erected to give protective irrigation.
- Evaluation of RC-1 and RC-2 varieties under water stress condition at farmers level through OFT indicated that these varieties are suitable for water stress condition. Testing of AR-12 variety at farmers' field indicated that, AR-12 is suitable for alkaline soil under irrigated conditions.

- Trials of INM resulted in improvement in leaf quality and yield up to 9%. Evaluation of mulberry tree plantation was conducted to develop suitable packages for tree plantation in water stress areas. Organic farming for sustainable mulberry leaf production was assessed at field under irrigated condition which increased the leaf yield by 5.32%.

- On Station Trials (OST) of three way cross hybrids FC1 X CSR2 and FC3 x CSR17 had shown higher survival and yield than the control hybrids.

- Production and release of 104 pouches of *N. thymus* at field level reduced uzi fly infestation from 14.11 to 6.27%. Release of 32 boxes of lady bird beetles (*C. montrozieuri* / *S. coccivora*) at field level reduced mealy bug infestation from 20.67% to 6.83%.

- A total of 60 farmers in three batches were trained under the ISDS and 180 farmers under need based programmes. Further, 3350 farmers were benefited through their participation in 35 extension communication programmes conducted.

RSRS, KODATHI

- On-Station Trials (OSTs) were undertaken on the mulberry varieties RC1 and RC2, Navinya for management of root rot and INM practices in mulberry. Further, OST of two three-way cross hybrids (FC3 x CSR17, FC1 x CSR2), single hybrid (2C x 4S) and double hybrid (G11 x G19; D1 x D2; D2 x D3) and multi x biv hybrids (NDV6 x CSR51; L14 x CSR50). The results showed the superiority of the test hybrids over the controls in terms of higher cocoon and post-cocoon traits.
- During the period 549 soil samples were analyzed and suitable soil amelioration measures were suggested.
- Under PAT programme, a total of 44,225 Dfls of CSR16 x CSR17, CSR46 x CSR47, GEN3 x GEN2 and APS45 x APS12, were distributed to 178 farmers by Station and its RECs and an average yield of 62.83 kg/100 dfls was recorded. Further 42,700 Dfls of L14 x CSR2 were distributed which showed an yield of 56.8 kg/100 dfls.

- Technologies like INM, IPM for Tukra and Uzi, composting and Navinya for root rot were demonstrated to 218 farmers by RSRS and nested units.

- Training was imparted to 75 persons in four batches under ISDS and 975 farmers in 65 programmes under technology upgradation. A total of 139 events were organized by RSRS and nested units in which 5065 farmers were sensitized.

RSRS, SALEM

- OST of two three-way cross hybrids (FC3 x CSR17, FC1 x CSR2), single hybrid (2C x 4S) and double hybrid D1 x D2; D2 x D3) and multi x biv hybrids (NDV6 x CSR51; L14 x CSR50) were taken up. The results showed the superiority of the test hybrids over the controls in terms of higher cocoon and post-cocoon traits.

- During the period 94 soil samples were analyzed and suitable soil amelioration measures were suggested.

- To mitigate the loss of papaya mealy bug, a quantity of 933 units (233250 numbers) of *Acerophagus papayae* was mass multiplied and released in infested mulberry gardens.

- A total of 14,990 stakeholders were sensitized through various Extension Communication programmes conducted by RSRS, Salem and its nested units.

- Under ISDS, 105 beneficiaries were trained to enhance their skill for their self sustenance. Training was also imparted to 1230 farmers in 82 batches under Technology Upgradation programme.
- The research station continues to be a centre for higher studies in Botany and Sericulture under Periyar University, Salem wherein 8 scholars were awarded with Ph.D. and 10 scholars are pursuing the doctoral work.

III. HIGHLIGHTS OF ACHIEVEMENTS UNDER CRITICAL COMPONENTS OF RESULTS FRAMEWORK DOCUMENT 2013-14

No.	Action	Unit	Target	Achmnt.	% Achmnt.
1	Projects initiated	No.	05	08	160
2	Projects concluded	No.	10	11	110
3	High yielding mulberry varieties develooped	No.	02	03	150
4	Absorption of varieties in the field	No	03	03	100
5	Improved Bivoltine hybrids developed	No.	03	03	100
6	Improved 3rd generation hybrids developed	No.	01	01	100
7	Absorption of breeds in the field	No.	03	03	100
8	Absorption of technologies	No.	02	07	350
9	Absorption of machines/equipments	No.	02	04	200
10	Absorption of packages	No.	02	09	450
11	Technologies commercialized	No.	03	07	233
12	Technologies taken up for patenting	No.	02	07	350
13	Stakeholders sensitized	No.	20000	30969	155
14	Coverage of clusters	No.	95	107	113
15	Coverage of beneficiaries	No.	19000	23094	122
16	New plantation with improved mulberry varieties	acres	130	1578.3	1214
17	Attention to field problems	No.	12	17	142
18	Solving field problems in clusters	No.	01	15	1500
19	Production of bivoltine raw silk through captive area	MT	1400	1402	100
20	Production of bivoltine raw silk through non-captive area	MT	110	120	109
21	Production ICB raw silk	MT	2100	2150	102
22	Stakeholders trained under ISDS	No.	310	518	167
23	Stakeholders trained under other programmes	No.	4250	4831	114
24	DFLs of basic seeds supplied	No.	18000	26167	145
25	Publication of research articles	No.	22	46	209
26	Publication of extension bulletins	No.	12	32	267
27	Publication scientific journals	No.	04	06	150
28	Forecasting & forewarning of pests & diseases	No.	13	30	231
29	Collaborative projects taken up	No.	02	03	150

IV. LIST OF RESEARCH PROJECTS AND PROGRAMMES

Institute/RSRS	Concluded		Ongoing		Total		Grand Total
	Project	Prog.	Project	Prog.	Project	Prog.	
CSR&TI	11	05	12	22	23	27	50
RSRS	-	05	01	01	01	06	07
Total	**11**	**10**	**13**	**23**	**24**	**33**	**57**

#	Proj. Code	Project Title	Category
PROJECTS CONCLUDED IN 2013-14 (MAIN INSTITUTE)			
1	PIN 3442	Studies on the factors influencing the nutrient uptake and its use efficiency in mulberry under field conditions (Jul. 2010 to Jun. 2013)	Input cost reduction
2	MOE 3463	Popularization of the productive bivoltine silkworm double hybrid Krishnaraja with the farmers of Karnataka (Oct. 2011 to Sep. 2013) – **funded by DST (WOS-B)**	Environmental challenges & global warming
3	AIB 3449	Studies on the development of indigenous method for culturing *Cordyceps* and other useful species (Oct. 2010 Sep. 2013)	Value Addition
4	PRP 3462	Biological control of root rot disease of mulberry by endophytic bacteria *Burkholderia cepacia* and *Bacillus subtilis* strains (Dec. 2010 to Dec. 2013) – **funded by DBT**	Eco friendly
5	PIE 3451	DNA marker aided analysis of mulberry gene bank towards a core assembly for sustainable conservation and enhanced utilization in crop improvement. (Oct. 2010 to Dec.2013)**- in collaboration with CSGRC, Hosur- funded by DBT**	Crop Improvement
6	PIB 3268	Development of superior mulberry varieties suitable for moisture stress environments (Phase-II) (Apr. 2002 to Mar. 2014)	Environmental challenges & climate change
7	PRE 3467	Evaluation of available management strategies for Giant African Snail (*Achanta fulica*) in mulberry ecosystem (Apr. 2012 to Mar. 2014)	Eco friendly
8	MOE 3458	A study on adoption of pest and disease management strategies in sericulture (Oct. 2012 to Mar. 2014)	Adoption Study
9	PPE 3455	Habitat studies Impact of crop diversity on conservation and performance of parasitoids and predators in mulberry crop system (Sep. 2011 to Aug. 2014) **(Concluded in Mar. 2014)**	Eco friendly
10	AIP 3478	Studies of mulberry leaf nutrition on intermediary metabolism of silkworm *B. mori* L. (Apr. 2012 to Mar. 2014)	Nutrition Study
11	AIB 3488	Pre-authorisation field trials of L14 x CSR2: A polyvoltine x bivoltine hybrid with superior fibre quality (Apr. 2012 to Mar. 2014) (**Extended upto March 2015)**	Environmental challenges & global warming

PROGRAMMES CONCLUDED IN 2013-14 (MAIN INSTITUTE)			
#	**Prog. Code**	**Programme Title**	**Category**
1	SPT 0024	Maintenance of silkworm pathogens and testing their virulence of periodic intervals (Jul. 2010 to Jun. 2013)	Maintenance
2	SPR 0041	Large scale multiplication of new multivoltine and bivoltine breeds (Apr. 2012 to Nov. 2013)	Breed Evaluation
3	SPR 0044	Development of silkworm rearing package for newly developed hybrids (Apr. 2012 to Nov. 2013)	Rearing Package
4	MPT 0049	Detection of virus in mulberry in hot spot area of Karnataka – A pilot study (Feb. 2013 to Mar. 2014)	Viral Disease
5	SPT 0045A	Identification of probiotic bacteria from the mulberry silkworm and study their antibacterial activity against the bacterial pathogens in silkworm *Bombyx mori* (Oct. 2012 to Mar. 2014)	Antibacterial Study
PROGRAMMES CONCLUDED IN 2013-14 (RSRS)			
6	SEM(S) 8001 (Salem)	Studies on adoption of silkworm disease control measures & its impact on cocoon production in farmers' field under Tamil Nadu conditions (Jun. 2010 to Jun. 2013)	Adoption Study
7	MPT(S) 8002 (Salem)	Studies on Rhizosphere microflora of mulberry varieties as influenced by different cultivation practices under alkaline soil conditions (Jul. 2010 to Jun. 2013))	Eco friendly
8	MPR(S) 8003 (Salem)	Effect of shoot harvest techniques and biomass yield of mulberry on soil organic carbon depletion in mulberry fields (Jul. 2010 to Jun. 2013)	Eco friendly
9	SEM(S) 8004 (Salem)	Studies on the adoption and impact of mulberry and silkworm pest management technologies (IPM) by the sericulturists in Tamil Nadu (Jul. 2010 to Jun. 2013)	Eco friendly
10	SEM(S) 8006 (Salem)	A study on the adoption of recommended package of practices followed by sericulturists of different farm size in Tamil Nadu (Jul. 2010 to Jun. 2013)	Adoption Study

ON GOING PROJECTS DURING 2013-14 (MAIN INSTITUTE)			
#	**Proj. Code**	**Project Title**	**Category**
1	PRE 3486	Development of Database for mulberry diseases (Aug. 2012 to Jul. 2014)	Database Development
2	AIB 3498	Popularization of authorized silkworm hybrids among the farmers of South India (Nov. 2012 to Oct. 2014)	Environmental challenges & global warming
3	PIB 3370	Development of superior mulberry varieties by exploitation of hybrid vigour based molecular diversity of promising parental lines (Apr. 2006 to Nov. 2014)	Crop Improvement
4	-	Popularisation of rotary mountages for quality cocoon production (Apr.2013 to Mar. 2015) **funded by JICA**	Rearing Technology
5	AIB 3476	Development of Productive NPV tolerant BV Breeds / hybrids carrying BmNOX marker assisted selection (Apr. 2012 to Mar. 2015)	Eco friendly
6	ARP 3477	Therapeutic control of Microsporidiosis in the silkworm through characterization of Methionine Amino Peptidase enzyme genes (MetAP2) in *Nosema bombycis* (Apr. 2012 to Mar. 2015)	Protozoan Disease
7	PIG 3502	Sustaining mulberry yields: Identification of QTLs conferring resistance to root rot disease by linkage disequilibrium mapping and trait introgression. (Jun. 2013 to Jun. 2015) **Funded by DBT**	Eco friendly
8	AIT 3445	Development of robust bivoltine hybrids of silkworm *Bombyx mori* L. tolerant to high temperature environment of the tropics through DNA marker assisted selection (Jan. 2011 to Dec. 2015)	Env. challenges & global warming
9	AIB 3506	Studies on thermo tolerance, heat shock protein synthesis during thermal shock and inbreeding in silkworm, *Bombyx mori* L. (Jan. 2014 to Dec. 2015) **(SERB, DST funded)**	Env. challenges & global warming
10	PIB 3507.	Development of Distinctiveness, Uniformity and Stability (DUS) descriptors for mulberry (*Morus spp*.) and its validation. (Apr. 2013 to Mar. 2016) – **Funded by PPV & FRA, New Delhi**	Mulberry Descriptors
11	AIB 3456	Development of productive polyvoltine breeds of silkworm *Bombyx mori* L. tolerant to high temperature and BmNPV (Oct. 2011 – Sep. 2016)	Env. challenges & global warming
12	PIB 3457	Development of diseases resistance and productive mulberry genotypes with special reference to root rot and root knot diseases suitable for seri-zones of South India (Jan. 2012 to Dec. 2017)	Eco friendly
13	PPF 3500	Development of seri-lac culture model for income augmentation (Jun. 2012 to Dec. 2016) (RSRS Chamarajanagar) – **funded by IINRG, Ranchi**	Input cost reduction

#	Prog. Code	Programme Title	Category
1	SEM 0050	Demonstration of uzi fly management strategies in an adopted village of Srirangapatna taluk (Jun. 2013 to May 2014)	Eco friendly
2	MPT 0046	Long term effect of mulberry cropping system on soil biology and productivity (Jul. 2011 to Jun. 2014)	Eco friendly
3	SEM 0042	Sericulture women & technology transfer – A group approach (Jan.2013 to Jul. 2014)	Women friendly
4	MPR 0047	Effect of conjunctive use of nitrification inhibitors for the efficient utilization of nitrogenous fertilizers for the sustainable mulberry production (Oct. 2012 to Sep. 2014)	Input cost reduction
5	SIM 0008	Evaluation of three way cross hybrids for commercial exploitation (Aug. 2010 to Sep. 2014)	Input cost reduction
6	SEM 0052	On farm trials of Nimahari – A plant based formulation for control of root knot disease of mulberry (Oct. 2013 to Sep. 2014)	Eco friendly
7	SIM 0051	Improvement of breed characteristics of L14 through multi-locational breeding approach (Jun. 2013 to Dec. 2014)	Breed Improvement
8	SPT 0039	Identification of factors responsible for silkworm crop loss due to diseases at field level and its impact on cocoon productivity (Jul. 2012 to Dec. 2014)	Env. challenges & global warming
9	SIM 0062	Pre-authorisation field trials of newly developed improved cross breeds and bivoltine hybrids (Oct. 2013 to Dec. 2014)	Field Trial
10	SIM 0055	Field trial of reeling package for L14 x CSR2 hybrid (Jan. 2014 to Mar. 2015)	Input cost reduction
11	SPT 0045B	Application of probiotics for improving economic characters of silkworm, *Bombyx mori* L. (Apr. 2013 to Mar. 2015)	Eco friendly
12	MIP(A) 5001 (Ananthapur)	Evaluation of elite mulberry varieties under semi arid agro climatic condition (Aug. 2010 to Mar. 2015) (RSRS Anantapur)	Env. challenges & global warming
13	AICEM	All India Coordinated experimental trial for mulberry – Phase III (Jun. 2011 to Jun. 2015)	Env. challenges & global warming
14	MIP 0001	Maintenance of mulberry germplasm, mother culture and demonstration plots of improved mulberry varieties (Continuous)	Maintenance
15	MPR 0005	Monitoring of soil fertility status of mulberry gardens in Karnataka, Andhra Pradesh & Tamil Nadu & creation of data base (Continuous)	Input cost reduction
16	SIM 0006	Maintenance of silkworm races, strains and breeds (bivoltine, polyvoltine, amylase marker, NPV tolerant, mutants & semi-synthetic diet specific) (Continuous)	Maintenance
17	SPT 0014	Maintenance of mother culture for production of recommended biocontrol agents and mass release of recommended biocontrol agents of sericultural pests in CSRTI campus (Continuous)	Eco friendly
18	SIM 0015	Bivoltine silkworm race maintenance & multiplication (Continuous) Hassan	Maintenance
19	SIM 0016	Maintenance of CNR breeds (Continuous) – SSBS, Coonoor	Maintenance
20	SIM 0017	Bivoltine shuttle breeding for development of silkworms with better plasticity (Continuous) – SSBS, Coonoor	Breed Improvement
21	SPR 0019	Large scale in-house evaluation of new silkworm hybrids (Continuous)	Breed Evaluation
22	SIM 0037	Evaluation of post-cocoon parameters of cocoons generated from CSRTI, Mysore and its nested units (Continuous)	Post-cocoon Evaluation
23	MPT 0053	Forecasting and forewarning of mulberry pests (Continuous)	Input cost reduction

V. CONCLUDED RESEARCH PROJECTS/PROGRAMMES

1. HOST PLANT IMPROVEMENT

1.1 PIB-3268: Development of superior mulberry varieties suitable for moisture stress environments

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Duration: April 2002 to March 2014

Budget: Rs. 5.469 Lakhs

Objective:

- To exploit diverse genetic resources through purposive breeding to develop superior mulberry varieties for soil moisture stress environments.

Methodology

Twenty five mulberry germplasm accessions from CSGRC, Hosur and CSRTI, Mysore were short-listed as parents, based on 14 desirable characteristics following index score technique. A total of 36 crosses were made in two batches and a progeny of 3043 hybrids was raised. Adopting a four stage screening under natural soil moisture conditions, wherein genotypes with highly dissected leaves, excessive branching were rejected during the first stage. Leaf yield, growth, morpho-physiological parameters, sprouting and survival percentage were studied for two years in the next three stages to finally arrive at 32 promising hybrids. These hybrids were planted for PYE at three locations, CSRTI, Mysore, RSRS, Anantapur and RSRS, Chamarajanagar along with one germplasm accession and three checks [S13, S34 and V1]. The PYE was planted in 6 x 6 lattice with 4 replications. The PYE was conducted under moisture stress and non-stress conditions to shortlist hybrlds for FYE based on important morpho-physiological characters and leaf yield in both environments. Stability analysis was carried out for hybrid exploitation and ten promising hybrids were short-listed for FYE. The FYE experiments were established in all three locations in RBD with 4 replications along with S13 as check. The final yield evaluation was done for three years and selected hybrids were also subjected to bioassay.

Observations /Results

The initial selection of parents was done among the germplasm accessions based on 14 characteristics associated with drought resistance following Index Score Technique (Table 1.1)

Table 1.1: Characters considered for selection of parents

Leaf yield	Total shoot length	Length of longest shoot
Number of shoots	Leaf area	Leaf thickness
Palisade to spongy parenchyma ratio	Thickness of cuticle	Stomata frequency
Stomatal size	Moisture content	Moisture retention capacity
Volume of root	Dry weight of root	-

Thirty-six crosses were made among twenty (12 female and 8 male) selected parents (Table 1.2) in two batches to raise a progeny of 3043 hybrids.

Table 1.2: List of germplasm accessions selected for hybridization

Mulberry genotypes selected for hybridization			
Morus multicaulis	S 13	S 34	V 1
China peking	Local	LF 1	BR 1
Matigara	S 799	BR 4	Punjab local
Thai male	Himachal local	MS 6	Pakisthan 1-3
KPG 2	S 1	Sujanpur 1	LF 2

The seedlings were transplanted to screening plot and pruned after 6 months and provided with life saving irrigation soon after pruning. After 90 days of pruning 171 hybrids showing poor growth were rejected and data on total shoot length, no. of shoots/plant, no. of leaves / m were recorded for the rest of the hybrids. Based on the above said parameters 134 hybrids were short-listed. Data on SPAD values, leaf temperature, transpiration rate, diffusive resistance, 100 leaf weight, moisture content, moisture retention capacity and leaf yield were recorded for these 131 hybrids (Table 1.3).

Table 1.3: Variability in the short-listed hybrids (n=131) for leaf yield, yield contributing and physiological characteristics

Parameter	Leaf yld. (g/plant)	Total shoot length (cm)	No. of shoots / plant	Moisture content (%)	Moisture retention (%)	Transpiration rate (µg cm^2 sec^{-1})	Diffusive resistance (sec/cm)
Season-1 (July- Sept. 2004)							
Range	250-690	800-3310	6-22	68.5-79.5	50-70	3.59-50.2	0.30-7.38
Mean	426	1759	10.60	73.80	61.60	18.90	1.60
SD	94.20	500	2.90	3.30	4.90	9.45	1.33
CV (%)	52.60	28.40	27.20	4.50	8.00	50.20	84.00
Season-2 (Oct. - Dec. 2004)							
Range	110-600	600-3107	6-22	62-79	42.69	3.02-46.35	0.38-8.64
Mean	307	1608	10.20	71.80	58.30	15.35	1.76
SD	127	471	2.10	3.40	6.30	9.99	1.52
CV (%)	41.20	26.10	22.90	4.70	10.70	52.20	85.20
Season-3 (Feb. - Mar. 2005)							
Range	100-553	370-1980	6-20	60-77	41-67	2.22-23.25	0.71-9.65
Mean	250	1055	10.20	71.40	58.20	14.89	1.92
SD	95.30	375	3.90	2.90	5.10	12.52	1.64
CV (%)	36.70	35.50	27.10	4.00	8.70	53.65	86.00

The hybrids were further subjected to rooting evaluation to finally select 32 hybrids with a rooting ability of >80%. The details of the hybrids selected for PYE are listed in Table 1.4.

Table 1.4: Hybrids short-listed for PYE

Sl. No.	Cross	Final selection
1	BR 4 x S 13	10
2	BR 4 x S 34	05
3	BR 4 x Matigara	02
4	BR 4 x S 799	01
5	LF 1 x V 1	02
6	MS 6 x S 34	01
7	Punjab local x S 13	02
8	BR 1 x S 13	01
9	*M. multicaulis* x V 1	02
10	*M. multicaulis* x S 13	01
11	*M. multicaulis* x S 34	03
12	Punjab local x V 1	02
	Total	**32**

The 32 hybrids along with one germplasm accession and three checks (S13, S34 and V1) were evaluated in three locations at Mysore, Chamarajanagar and Anantapur under natural moisture and irrigated conditions. The data on leaf yield, morpho-physiological traits were recorded. At Mysore, genotypes 1, 4, 6, 17 and 21 significantly out yielded the check S13 under soil moisture stress. Genotypes 1, 4, 7, 17 and 26 yielded higher than the check V1 under non-stress environment. At Chamarajanagar, genotypes 4, 6, 7, 15 and 22 significantly out yielded the check S13 under soil moisture stress. Genotypes 4, 6, 7, 17 and 22 yielded higher than the check V1 under non-stress environment. At Anantapur, genotypes 7, 15, 16, 17, 23, 31 and 33 significantly out yielded the check S13 under soil moisture stress. Genotypes 4, 7, 26 and 33 yielded higher than the check V1 under non-stress environment (Table 1.5).

Table 1.5 a, b & c: Leaf yield of selected genotypes under soil moisture stress and non-stress environments.

a. Location: Mysore

Soil moisture stress		Non-stress	
Genotype No.	Leaf yield (kg/ha/yr)	Genotype No.	Leaf yield (kg/ha/yr)
1	22682*	1	62882*
4	22326*	4	67923*
6	23196*	7	60000*
17	20655*	17	60918*
21	19579*	26	59641*
Check S13	15330	Check V1	52075
CD at 5%	3575		5389
CV (%)	10.03		7.56

b. Location: Chamarajanagara

Soil moisture stress		Non-stress	
Genotype No.	Leaf yield (kg/ha/yr)	Genotype No.	Leaf yield (kg/ha/yr)
4	21122*	4	60723*
6	23387*	6	64500*
7	24061*	7	62150*
15	20143*	17	60000*
17	18122	22	60000*
22	21796*	25	58000
Check S13	17326	Check V1	54085
CD at 5%	2816		4714
CV (%)	9.23		17.24

c. Location: Anantapur

Soil moisture stress		Non-stress	
Genotype No.	Leaf yield (kg/ha/yr)	Genotype No.	Leaf yield (kg/ha/yr)
7	20000	4	58500*
15	20000	7	59000*
16	21500	17	58000*
17	22800*	26	60130*
31	22800*	23	62150*
33	20000		
Check S13	17896	Check V1	54120
CD at 5%	3673		3367
CV (%)	11.29		13.11

The ten most promising genotypes were multiplied and planted in the three locations also considering their performance in PYE at the given location for Final Yield Evaluation [FYE] experiment with five test genotypes and check S13, in RBD with four replications. Data on leaf yield and growth parameters were recorded for three years. Bioassay was also conducted for assessment of leaf quality in the selected genotypes. The results of the FYE are presented in Table 1.6.

Table 1.6 a, b, c: Leaf yield and yield contributing characters of genotypes evaluated in FYE under soil moisture stress environments.

a. Location: Mysore

Gen. No.	Cross	Yield (kg/plant)	TS (No.)	LLS (cm)	TSL (cm)	MC (%)	MRC (%)
1	BR-4 x S-13	0.486	7.02	117.72	695.2	76.44	74.87
2	BR-4 x S-13	0.614 (20.4%)	8.85	144.06	1186.5	77.23*	74.76
3	BR-4 x S-13	0.497	7.25	140.95	1835.7	76.17	75.17
4	BR-4 x Matigara	0.545	6.95	137.25	803.9	77.33*	76.22
5	MS-6 x S-34	0.443	7.79	141.79	904.1	77.69*	72.29
6	S - 13 [Check]	0.510	8.00	145.04	1092.3	75.88	73.02
	CD at 5%	0.098	NS	NS	NS	0.79	NS

b. Location: Chamarajanagara

Gen. No.	Cross	Yield (kg/plant)	TS (No.)	LLS (cm)	TSL (cm)	MC (%)	MRC (%)
1	BR-4 x S-13	0.275	5.20	133.53*	521.78	64.51*	67.87
2	BR-4 x S-13	0.279	4.95	133.25*	513.15	63.98	68.49
3	BR-4 x S-13	0.313 (17.23%)	5.70	143.13*	588.95	64.61*	68.35
4	BR-4 x S-34	0.292	5.25	134.73*	551.48	64.08*	68.48
5	BR-4 x Matigara	0.312	5.50	138.94*	566.23	64.67*	69.21
6	S - 13 [Check]	0.267	5.03	117.23	504.15	62.95	68.07
	CD at 5%	0.036	NS	9.30	NS	1.15	NS

c. Location: Anantapur

Gen. No.	Cross	Yield (kg/plant)	TS (No.)	LLS (cm)	TSL (cm)	MC (%)	MRC (%)
1	BR-4 x Matigara	0.394	5.58	176	874*	69.38	68.62
2	BR-4 x Matigara	0.414	5.11	146	608	69.66	69.57
3	*M. multicaulis* x V-1	0.561 (35.51%)	6.22*	183*	987*	71.12*	73.38*
4	Punjab local x V-1	0.482	5.36	171	802	70.34*	69.56
5	Punjab local x V-1	0.518	5.39	180*	804	70.46*	70.18
6	S - 13 [Check]	0.414	6.01	173	814	70.22	70.21
	CD at 5%	0.028	0.41	6.18	73.4	0.95	1.65

TS – No. of shoots/ plant; LLS – Length of the longest shoot; TSL – Total shoot length; MC – Moisture content in leaf; MRC – Moisture retention capacity of leaves after 6 hrs of excision.

At the end of the project period, three hybrids were selected for the three zones. Two of the three genotypes selected at Mysore and Chamarajanagara are hybrids of BR-4 x S-13 and the one selected at Anantapur is a hybrid of *M. multicaulis* x V1. The hybrids have been rechristened as MSG2 [Mysore], MSG7 [Chamarajanagara] and MSG 26 [Anantapur] based on their PYE number. The bioassay with PM x CSR2 hybrid silkworm was done with the three hybrids and they were found on par with S13 in respect of cocoon yield, and reeling parameters.

The selected varieties are being multiplied at the respective stations for further validation through multilocational trials under moisture stress conditions.

Parameters			
	MSG-2	**MSG7**	**MSG26**
Species	*Morus indica*	*Morus indica*	*Morus indica*
Sex	Female	Male	Male
Plant type	Erect	Erect	Erect
Ploidy	Diploid	Diploid	Diploid
No. of shoots / plant	8.85	5.70	6.22
Total length of shoots (cm)	1186	588.95	987
Leaf shape	Cordate	Cordate	Ovate
Leaf surface	Smooth	Smooth	Glabrous, thick & smooth
Leaf yield (mt /ha/yr)	22.74	12.92	20.77
Leaf yield in S13 (Check)	18.8	11.04	15.33

1.2 PIN 3442: Studies on the factors influencing the nutrient uptake and its use efficiency in Mulberry under field conditions

M. G. Sabitha (PI), N. B. Chowdary and K. Vedavyasa

Duration: July 2010 to June 2013

Budget: Rs. 3.195 Lakhs

Objective:

- To study the factors affecting the uptake of nutrients by mulberry and the leaf quality under field conditions.

Methodology

During the evaluation process soil and leaf samples was collected from 200 farmers of three southern states (Karnataka- 9 districts – 90 farmers; Andhra Pradesh- 6 districts – 60 farmers and Tamil Nadu – 5 districts – 50 farmers). Soils samples were subjected for estimation of soil aggregates such as soil chemical analysis (pH, EC, OC, P and K, micronutrients - Fe, Zn, Mn, Cu). The soil physical parameters like bulk density, percent pore space and water holding capacity were analysed. The leaf samples were analysed for nutritional (proteins and carbohydrates) and biochemical (N, P, K, S, Ca, Zn, Cu, Fe, Mg and Mn) parameters. The details on leaf yield and cocoon harvest were collected from the farmers. The data has been subjected for correlation studies to find out the factors responsible for the plant nutrient uptake at farmers field.

Observations/Results

The soil mineral composition showed relatively higher range of available P in Ithandahally in Karnataka (62.2-147.3 kg/ha, while the lowest values were observed in Hosur, TN (7.45-17.42 kg/ha). Available potassium was found to be higher in Guntur in AP (538-806 kg/ha), while lower range was seen in Hosur (90 - 269 kg/ha). Analysis of soil micronutrients revealed higher Cu content in Guntur, AP (3.08 - 5.10 ppm), while lower values were observed in Hosur (0.26 - 1.40 ppm). The Zn was found to be higher in Bangarpet (0.80 - 3.20 ppm, which was lower in Udumalpet (0.10 - 0.40 ppm. Iron content was higher in samples of Vijayawada (11.40 - 92.0 ppm), while lower values found in Udumalpet (1.60 – 5.40 ppm). Higher

range of Mn was observed in Madakasira (45.1 to 61.8 ppm) and Hosur samples showed lower ranges (2.0 - 5.0 ppm).

The leaf elemental status showed higher values of N in V. Kota (3.92 - 4.97 %), while it was lower in Channarayapatna (1.14 - 1.70 %). Values of Phosphours and Potassium did not vary among the soil samples which ranged from 0.13 to 0.44 % and 0.47 to 1.62 % respectively, With regard to micronutrients; higher range was observed for Copper in Hindupur (268 - 535 ppm), while lower values were found in Pandavapur (10 - 20 ppm). Zinc was found to be high in Pandavapur (50 - 125 pm), while Yelandur showed lower values of 24 - 43 ppm. Higher range of Iron content was observed in Y.N. Hosakote (615 - 852 ppm), which was lower in Channarayapatna (72 - 97 ppm). Manganese was found to be higher in Bangarpet soil samples (75 - 275 ppm) and lower values were seen in Udumalpet (19 - 35 ppm).

The nutritional parameters in the leaf samples showed higher values of protein (163.9 - 204.5 mg/g) in Gobi samples, which was found to be lower in V. Kota (106.5 - 128.4 mg/g). The carbohydrate content was higher in Ithandahally (106.9 - 138.5 mg/g), while samples of V. Kota showed relatively lower values (98.3 - 102.7 mg/g). The annual leaf yield per acre was found to be highest (17800 - 19200 kg) in Udumalpet area, while relatively lower yields were obtained in Ithandahally (11800 - 13800 kg). The cocoon yield per acre was higher in Palamner (300 - 500 kg) which was lower (250 - 300 kg) in Bangarpet.

To know the factors responsible for the uptake of nutrients, correlation analysis was carried out using the soil chemical parameters like pH, EC, OC, soil physical parameters like bulk density, pore space and water holding capacity (MWC) as well as N, P and K as independent variables. The dependent variables in the soil sample were available P and K, micronutrients, Cu, Zn, Fe and Mn, the results of which are shown in Table 1.7

Table -1.7: Correlation between soil parameters and macro / micro Nutrients in the soil

Independent variables	**Dependent variables**					
	Av. P	**Av. K**	**Cu**	**Zn**	**Fe**	**Mn**
pH	-0.320***	0.040	0.016	- 0.280***	- 0.248***	- 0.242***
EC	0.214**	0.092	0.110	0.033	0.064	0.200**
SOC	0.221**	0.210**	0.134	0.331***	0.200**	0.394***
BD	0.030	- 0.210**	- 0.309***	- 0.193**	- 0.212**	- 0.212**
MWC	0.093	0.269***	0.451***	0.206**	0.120	0.096
Porosity	0.028	0.221**	0.432***	0.171*	0.059	0.031
Soil N	0.007	0.043	0.001	0.000	0.038	0.033
Soil P	0.097	0.110	0.247***	0.175	0.049	0.139*
Soil K	0.057	0.145*	0.269***	0.057	- 0.151*	- 0.044 *

The data clearly showed that soil pH has negative impact on available nutrients like phosphorus, zinc, iron and manganese in the soils, while organic carbon, showed positive relationship with macro and micronutrients in soil. The bulk density revealed negative impact on macro and micronutrients in the soil, while MWC and porosity showed positive effect on Potassium Cu and Zn.

The dependent variables in leaf samples were N, P, K and micronutrients, Cu, Zn, Fe and Mn and the results are depicted in Table 1.8. The data showed that pH and bulk density has positive impact micronutrients in the leaf, while MWC and porosity showed negative effect on the micronutrients.

Table 1.8: Correlation between soil parameters and macro / micro Nutrients in the leaf

Independent variables	**Dependent variables**						
	Leaf N	**Leaf P**	**Leaf K**	**Cu**	**Zn**	**Fe**	**Mn**
pH	0.078	0.332***	0.014	0.205**	0.056	0.235***	0.369***
EC	0.160*	0.115	- 0.324***	0.343***	0.050	0.119	0.106
SOC	- 0.144*	0.091	0.129	- 0.149*	0.040	0.084	0.067
BD	0.064	0.035	0.070	0.278***	0.273***	0.196**	0.088
MWC	0.028	- 0.226***	0.120	- 0.171*	- 0.243***	0.119	- 0.173*
Porosity	0.142*	- 0.260***	0.029	- 0.190**	- 0.239***	- 0.144*	- 0.183**
Soil N	- 0.176*	0.068	0.030	0.066	0.083	0.049	0.169*
Soil P	0.068	0.038	0.018	- 0.135*	- 0.138*	0.070	0.021
Soil K	- 0.003*	- 0.277***	0.097	- 0.165*	0.025	0.079	0.115

Correlation between the said independent variables and the nutritional parameters like Protein, Carbohydrate as well as the leaf and cocoon yield were also analysed as shown in Table 1.9. The soil pH and EC showed negative impact on proteins, carbohydrates and leaf yield, while OC and MWC showed positive effect on these parameters.

Table 1.9: Correlation between soil parameters and leaf nutrition, leaf yield and cocoon yield.

Independent variables	Dependent variables			
	Protein	Carbohydrate	Leaf Yield	Cocoon Yield
pH	- 0.250 ***	- 0.205**	- 0.253 ***	0.059
EC	- 0.205 **	- 0.230 ***	0.083	0.014
SOC	0.247 ***	0.091	0.242 ***	0.106
BD	0.048	- 0.171*	- 0.249 ***	0.118
MWC	0.087	0.192 **	0.252 ***	0.074
Porosity	0.063	0.157 *	- 0.279 ***	0.113
Soil N	0.133	0.048	0.145 *	0.132
Soil P	0.160*	0.034	0.080	0.026
Soil K	0.073	0.080	0.016	0.099

*, ** and *** denote significance at 0.5%, 1 % and 0.001 % respectively.

The overall results indicated that two soil chemical parameters such as pH, OC and three soil physical properties such as Bulk Density, maximum water holding capacity and Percent pore space are the major factors for alteration of macro/micro nutrients in soil and mulberry leaf. The analysis showed that the inputs applied by the farmers to the mulberry gardens in three states (Karnataka, Andhra Pradesh & Tamil Nadu) are having adverse affect on the soil fertility status, biomass production and cocoon yield. Hence farmers are to be advised about the importance of soil testing and appropriate application of chemical and organic manures as per the soil test based reports.

1.3 PIE 3451: DNA marker aided analysis of mulberry gene bank towards a core assembly for sustainable conservation and enhanced utilization in crop improvement (DBT sponsored project in collaboration with CSGRC, Hosur)

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[1]CSGRC, Hosur

Duration: October 2010 to December 2013

Budget: Rs. 35.30 Lakhs

Objectives:

- Identification of a panel of diverse mulberry germplasm amenable to association mapping by marker (by genomic and EST SSRs) aided analysis – CSRTI, Mysore.
- Construction of a core sub-set of mulberry germplasm by phenotypic and molecular marker (SSRs) analysis – CSRTI, Mysore & CSGRC, Hosur.
- Evaluation of panel of diverse mulberry germplasm for other important traits *viz*., sprouting, senescence, rooting, leaf quality, yield contributing traits and key morphological characters – CSGRC, Hosur.

Methodology

The mulberry germplasm accessions were collected from field gene bank at CSGRC, Hosur. In addition, some of the collections (working germplasm and breeders' collection) maintained at CSRTI, Mysore was also utilized in the project. The unique collection (UC) comprising of 520 accessions was established under ARBD plot for the characterization of key quantitative and qualitative traits. The characters were recorded based on the norms proposed by Dandin (1989) and Thangavelu *et al*. (2000). High molecular weight genomic DNA was isolated from young mulberry leaves and 70 selected mulberry specific SSR markers were amplified in 10 µl reaction volume and the amplicons were resolved in 8% non-denaturing PAGE and visualized by silver staining.

All the statistics and computations were carried out using suitable packages in R, unless indicated otherwise. Gowers (1971) genetic distance measure was used for mixed variables having both qualitative and quantitative traits. Weighted Neighbor joining method was used to generate cladogram using Gowers genetic distance. Allele sizes were converted into allelic frequency and used in the calculation of Modified Rogers Genetic Distance (MRD) using custom PERL and R scripts. MRD genetic distance was used to generate cladogram based on NJ method in DARwin software and the same was also used in PCoA analysis. Structure 2.2.3 was used to infer population structure of the WC, UC, panel of diverse germplasm and core subset. Delta K (Evano *et al*., 2005) was used to determine the optimum assumed population size (K). Phenotypic data of WC (1065 acc.) was used to sample UC (520 acc.) using Maximization method implemented in MSTRAT software and Ward's minimum variance followed by proportional sampling (WMV-P). Panel of diverse germplasm (300 acc.) and core subset (150 acc.) were sampled from SSR data using Similarity Elimination method (SimEli; Krishnan *et al*., 2014) and by mixed replica search using Core Hunter software. Both phenotypic data and SSR data were combined to sample panel and core collection with same number of entries as sampled using SSR marker data. The SSR and phenotypic marker data were also used in PowerCore for sampling diverse entries.

Observations/Results

A total of 36 mulberry genotypes designated as Breeders' collection (used as mandatory accessions) was genotyped using 70 mulberry specific SSR markers (Krishnan *et al*., 2013). The whole collection (WC) consisting of 1065 mulberry germplasm was analyzed to sample a UC using 29 key phenotypic markers. Cluster analysis based on phenotypic markers resulted in 20 distinct groups (Wards' minimum variance method). A total of 520 unique collections were sampled based on genetic distance and the number of entries was sampled proportional to the size of the cluster (WMV-P method). The short-listed accessions included 36 mandatory breeders' interest genotypes (Kernel). Maximization strategy (MSTRAT) was also used for identifying the UC (520) from the WC and compared with of WMV-P method. Overall, the identification of UC by WMV-P method retained 99% of the range of the WC compared to that of maximization method (89%). Out of the nine traits analyzed, as many as 7 traits showed 100% range retention in the former method.

The WC was profiled using mulberry specific polymorphic SSR markers. These 20 SSR markers generated a total of 152 alleles with an average of 7.6 alleles per loci. Allelic frequency data of whole collection was used to calculate Modified Roger's genetic distance (MRD). MRD values were used to calculate principal components in Principal Co-ordinate Analysis (PCoA) and the first two principal components were plotted in scatter plot. Scatter plot depicted the diversity in the WC, majority of the accessions were far apart, and the genetically similar and redundant accessions showed close association (Fig.1.1).

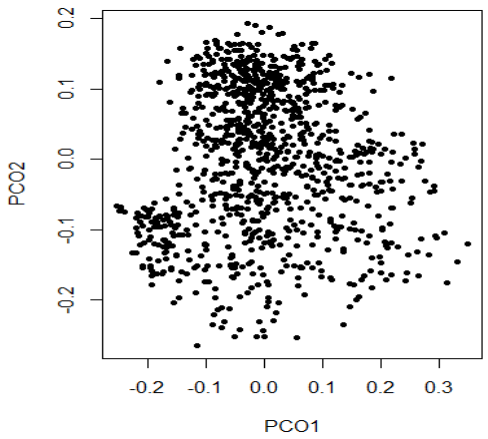


Figure 1.1: Scatter plot showing the distribution of diversity in the whole collection

. Micro-satellite allelic data was used in STRUCTURE analysis and the program was run for ten K values (K=1 to 10) in ten replicated runs using 20,000 burn-in and 20,000 MCMC values. LnP(D) value increased with increase in K values whereas Delta Kvalue was maximum at K=4 (Fig 1.2)

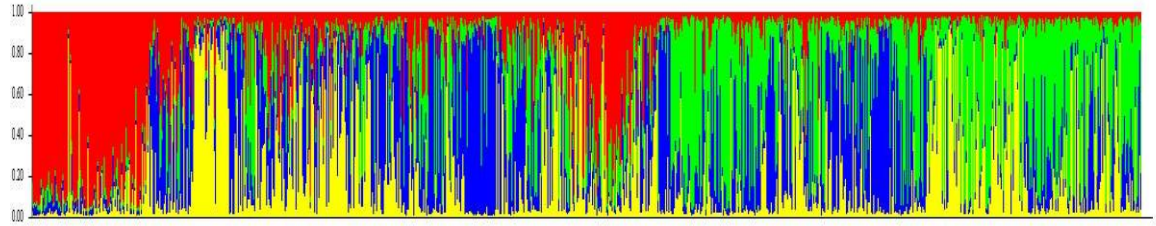


Figure 1.2: STRUCTURE bar plot depicting the genetic structure of WC (K=4)

At K=4, mulberry cultivars of the Indian subcontinent grouped with Chinese and Japanese collections, which confirmed the presence of exotic progenitors in Indian mulberry cultivars. Indian wild mulberry formed separate group indicated the reproductive and taxonomic isolation from rest of the accessions. Other Indian mulberry accessions belonging to *M. indica* and *M. alba* formed separate group. Exotic mulberry accessions collected from other parts of the world also formed a separate group. The presence of large number of admixtures in the grouping indicated the spread of mulberry far from the places of origin. We intended to sample a diverse germplasm of required size, diversity and structure for association/LD mapping. A panel of diverse germplasm were sampled by using 50 polymorphic SSR markers and as well as by combining SSR and phenotypic markers. Various sampling strategies like SimEli were used for sampling genetically distant entries and Core Hunter for sampling diverse entries by retaining maximum number of alleles. Size of the panel is maintained uniformly as 300, irrespective of sampling strategy and type of data used.

As expected, SimEli method sampled genetically distant entries with high Entry to Nearest Entry (E-NE) distance (0.407). In contrast, Core Hunter sampled diverse entries by retaining higher number of alleles along with some genetically close entries to capture rare alleles. Panels sampled using SSR markers as well as by using combined data were evaluated using mean range retention criteria of 16 quantitative traits. Panel sampled by using combined data retained marginally more range than sampled using SSR marker data alone (Table 1.10).

Table 1.10: Performance of panel sampled using SimEli and Core Hunter method

Sampling method	Percentage of alleles retained	Mean genetic distance (E-E)	Minimum genetic distance (E-NE)
SSR data			
SimEli_panel (300)	99.41	0.589	0.407
CH_panel (300)	99.70	0.587	0.081
Combined data			
SimEli_panel (300)	99.11	0.586	0.348

However, combined data retained only 0.50% more than the SSR data, indicating higher correlation between phenotypic and SSR markers. Modified Rogers' genetic distance was calculated for panel of diverse germplasm and used in the generation of NJ cluster and PCoA analysis. In the NJ cluster, Breeders' collection genotypes formed separate group along with some of the indigenous and exotic genotypes. Wild mulberry accessions belong to the *M. leaviagata* formed separate cluster and the other wild mulberry species - *M. serrata* also formed a distinct cluster. However, both these clusters have close association, when compared to the rest of the accessions, which indicates the taxonomic distinction and reproductive isolation with other mulberry collections. Cultivated Indian mulberry species like *M. alba* and *M. indica* lacked distinctions in clusters and thus supporting the taxonomic ambiguity existing in the classification of these two species. At K=4, genotypes of the Breeders' collection formed separate group except Doomar Nali and Lamia Bay, the wild mulberry species. Core collection with 150 entries was sampled from unique collection using different sampling strategies including SimEli and Core Hunter for SSR marker data and SimEli and PowerCore for combined data.

Performance of different sampling strategy in core collection development was similar to the one observed in the panel of diverse germplasm (Table 1.11).

Table 1.11: Performance of core collection sampled using different sampling strategies

Sampling method	% of alleles retained	Mean GD (E-E)	Min GD (E-NE)
SSR data			
SimEli (150)	97.34	0.616	0.452
Core Hunter (150)	98.82	0.695	0.241
Combined data			
SimEli (150)	97.34	0.600	0.387
PowerCore (84)	100	0.523	0.223

Core Hunter sampled a core subset with greater number of alleles whereas SimEli sampled entries with greater entry to nearest entry distance. PowerCore sampled 84 entries by using combined data and the size of the core collection in PowerCore is determined automatically based on the diversity of the whole collection. The cladogram of entries of the core subset obtained by NJ method can be sub-divided into four groups (Fig. 1.3). Breeders' collection genotypes exclusively placed in a separate cluster along with two indigenous and one exotic entry. In one of the cluster, indigenous and exotic entries were not separated, indicating the spread of mulberry from the place of origin to the rest of the world. Moreover, mulberry is propagated clonally through stem cuttings, preventing the mixing of genomes of exotic mulberry with the native collections. Wild mulberry belonging to *M. serrta* and *M. laevigata* formed a separate cluster, indicating the taxonomic and reproductive isolation from the rest.

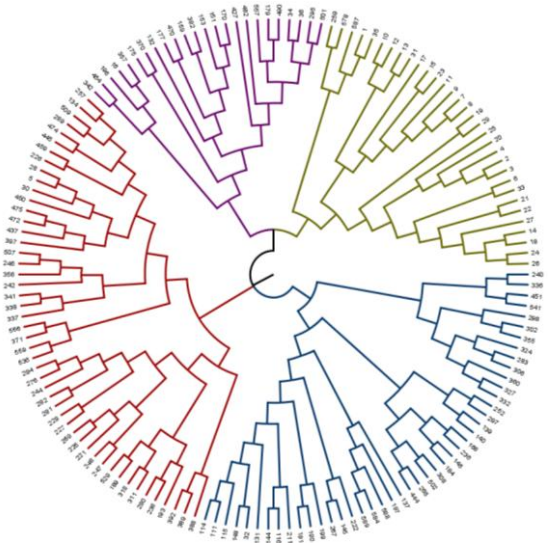


Figure 1.3: NJ cluster illustrating the diversity of the core collection sampled using SimEli (SSR data)

Delta K value showed maximum at K=1 and decreased progressively with the increase in K value. However, the same assumed population size (K=4) was determined based on Δk as in the case panel of diverse germplasm. The grouping of genotypes was similar to the one depicted in case of the panel. The genotypes of breeders' collection formed a separate group along with some of the Chinese and Japanese entries. Wild mulberry species of India, indigenous entries and exotic mulberry were represented in three groups. We also mined > 2.17 lakh mulberry specific SSRs from the whole genome and 962 SSRs from EST sequences of *M. notabilis* (communicated). All the markers were archived in mulberry microsatellite database (MulSatDB) and markers from EST sequences were functionally annotated and those from whole genome were mapped on the strawberry (*Fragaria vesca*) chromosomes to aid the selection of markers based on the function and location. Primer3plus and CMap tools were integrated in the database to design primers for PCR and to visualize markers on chromosomes, respectively. MulSatDB can be accessed at www.btismysore.in/mulsatdb or http://192.168.10.251/mulsatdb/ . These new SSR markers will be utilized in genotyping of the panel of diverse germplasm for association mapping of traits of interest in mulberry genetic improvement.

2. HOST PLANT PROTECTION

2.1 PRP 3462: Biological control of fungal root rot disease of mulberry by endophytic bacteria *Burkholderia cepacia* and *Bacillus subtilis* strains (DBT funded project)

V. Gunashekar (PI), B. R. Dayakar Yadav (upto 31.12.12) and S. M. H. Qadri (upto 31.03.13)

Duration: November 2010 to November 2013

Budget: Rs. 13.15 lakhs

Objectives:

- Effect of cell free culture filtrates (CCF) of endophytic bacteria, *Burkholdera cepacia, Bacillus suntilis* and *Pseudomonas aereginosa* on radial growth and dry mass of root rot pathogen Rhizoctonia bataticola.
- Development of rifampicin resistant bio-control agents (BCA'S) and bio-formulations of BCA'S and root rot pathogen *Rhizoctonia bataticola.*
- *In vivo* evaluation of BCA'S on the control of root rot disease of mulberry under glass / green house conditions.

Methodology

Survey was undertaken at Mysore, Chamarajanagar, Hassan, Malavalli, Kanakapura districts. Soil and root samples were collected from farmer's fields of healthy and root rot infested mulberry to see the association of those endophytic bacteria. Bacteria was isolated and identified following standard procedure. 70 isolates of *Burkholderia cepacia* and 40 isolates of *Bacillus subtilis* and 4 *P.aeruginosa* endophytes were screened *in vitro* for their antagonistic activity towards *R. bataticola* using dual culture method and also cell free culture filtrates using food poison technique. Effect of antagonistic bacteria on the hyphal morphology of *R. bataticola* was done following Xianling Ji et al. (2010). Four effective isolates from mulberry root endophytes were tested for siderophore production. Chrome azurol S (CAS) agar assay as described by Schwyn & Neilands (1987) and was modified by Silvastenico et al. (2005) was used. Spontaneous chromosomal rifampicin resistant (rif +) mutants of *B. cepacia*. *B. subtilis* and *P. aeruginosa* strains were generated to quantify the population of antagonistic endophytic bacterial population in soil and in mulberry root, stem and leaf. rif+ mutants of *B. cepacia. B. subtilis* and *P. aeruginosa* strains were mass multiplied following (Vidhashekaran et al., 1998; Bashan, 1986; Digat, 1990) and pathogens were multiplied following the method of Nishitha naik, (2008). *In vivo* evaluation of BCAs was conducted under glass house conditions using challenge inoculation method using mulberry cuttings / saplings in pot culture experiments following standard methods. To know the establishment of BCA's the inoculated rif+ B*. cepacia, B. subtilis* and *P. aeruginosa* were re-isolated from the root and leaf of the inoculated plants following standard procedures at frequent intervals at least once in 30 days.

Observation/Results

Cell free culture filtrates of *B. cepacia, B. subtils* and *P.aeruginosa* were tested on the suppression of *R. bataticola* radial growth and dry mycelial mass at 10%, 25% and 50% concentration. At 25% and 50% concentration (v/v) all the strains completely suppressed the growth of *R. bataticola.* At 10% concentration of CCF *B. cepacia* suppressed the radial growth up to 91.75% followed by *P. aeruginosa* (85%) and *B subtilis* (75%). Similarly, the fungal dry mass was decreased as the CCF concentration was increased in all the strains (Table 2.1). Rifampicin resistant mutants of *B. cepacia, B. subtilis* and *P. aeruginosa* at 100 µg / ml were generated. Further antagonistic nature against root rot pathogen and compatibility of the mutants were confirmed (Fig. 2.1).

Efficient *rif+ B. cepacia, B. subtilis* and *P.aeruginosa* were mass multiplied on talc based formulization and stored in conical flasks at room temperature. The viability of BCA's was estimated based on cfu/g talc powder at thirty day intervals. The cfu ranged between 145 -150 at 30 days and it gradually reduced as the days increased. At 120 day interval it was ranged up to 7-8 X 10^8 cfu /g talc (Table 2.2). Further evaluation is in progress.

Table 2.1: Effect of cell free culture filtrates (CCF) of selected antifungal strains of *B. subtilis P. aeruginosa and B. cepacia* on radial growth and mycelial dry mass of *R. bataticola*

Sl.No	Bacterial strain	CCF %	Colony diameter in cm	Dry mass (g)	% Inhibition
1	*Burkholderia cepacia*	50	00.00.	0.018	92
		25	00.00	0.048	81.01
		10	00.66 (91.75%)	0.093	61.50
2	*Bacillus subtilis*	50	00.00	0.029	95.91
		25	00.00	0.071	90.19
		10	02.00 (75 %)	0.225	68.92
3	*Pseudomonas aeruginosa*	50	00.00	0.020	97.23
		25	00.00	0.020	96.68
		10	01.20 (85 %)	0.024	96.40
4	Consortium of three Bacteria	50	00.00	0.013	94.62
		25	00.00	0.029	88.01
		10	00.60 (92.5%)	0.065	73.55
5	Control 1	Nil	08.00	0.724*	-
6	Control 2	Nil	08.00	0.242*	-
	CD 5%		0.110	0.056 (C1) 0.052 (C2)	-

*C1 – control for *B. subtilis* and *P. aeruginosa,* *C2- Control for *B. cepacia* and consortium
Figure in parenthesis indicates the % suppression of radial growth when compared with control.

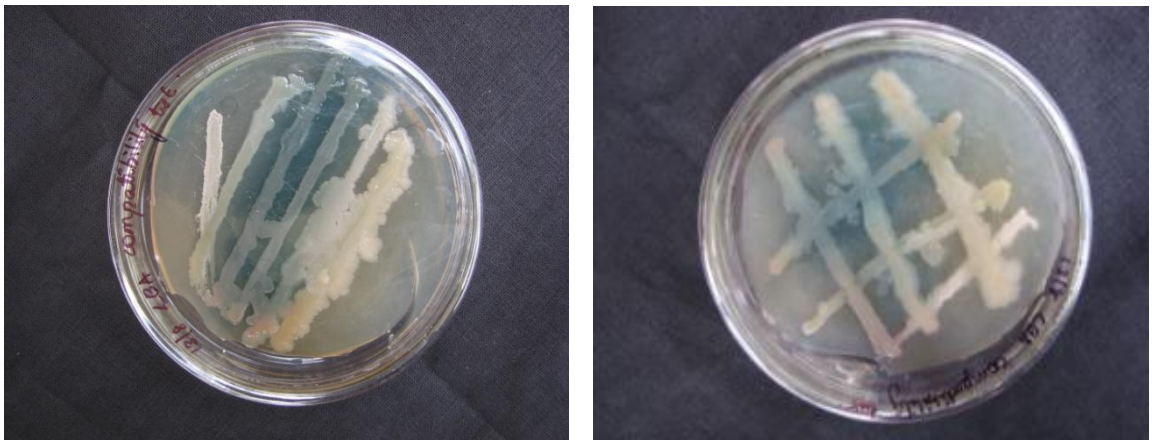


Fig. 2.1: Compatability of BCA's *B. subtilis P. aeruginosa* and *B. cepacia*

Root rot disease control under green house condition was evaluated in pots with mulberry cuttings and saplings as the mulberry is propagated only with cuttings. The control and suppressive effect on disease varied with the bacterial strains. Among the bacterial strains used, *P. aeruginosa* showed the higher survival of cuttings (Table 2.3). Root rot control on mulberry saplings is under progress, as the mulberry is a hard, woody perennial plant and the earlier studies revealed that the disease in saplings will be initiated after 90 days of inoculation of pathogen.

Table 2.2: Viability of antagonistic bacteria on talc based formulation cfu / ml x 10^8

Baceterial strains	Number of days after inoculation				
	30	60	90	120	150
B. cepacia	150	49	18	8	1
B. subtilis	152	52	19	9	2
P. aeruginosa	149	48	15	7	1

Table 2.3: Effect of BCA's on survival of mulberry cuttings in the presence of root rot pathogen *R. bataticola*

Treatments	Cutting	Cuttings dead after infestation days after plantation planted							
		30	45	60	75	90	Total dead	Total survival	% Survival
B. cepacia	25	2	3	0	2	0	7	18	72
B. subtilis	25	3	0	2	1	2	8	17	68
P. aeruginosa	25	1	2	1	2	0	6	19	76
Control	25	5	2	5	3	2	17	8	32
Absolute control	25	0	0	0	1	1	2	23	92

3. SILKWORM CROP IMPROVEMENT

3.1 MOE 3463: Popularization of productive bivoltine double hybrid (CSR6 x CSR26) x (CSR2 x CSR27) 'Krishnaraja' with the farmers of Karnataka

Sowmyashree (**PI)** and A. Naseema Begum

Duration: October 2011 to September 2013

Budget: Rs 10.39 lakhs

Objective:
- To popularize bivoltine silkworm double hybrid 'Krishnaraja' with the farmers of Karnataka.

Methodology

A survey was conducted at Srirangapatna taluk, Mandya district, Karnataka state and selected ten farmers from five villages out of 38 farmers in 13 villages based on farmers having separate rearing house and irrigated mulberry garden with V1 variety. Ten farmers in five villages were selected for rearing of double hybrid along with the control F1 hybrid (CSR2 x CSR4) in Srirangapatna taluk. The following activities were carried out before distribution of the double hybrid dfls to the farmers. The parental breeds were raised in the laboratory and dfls of double and control hybrids were prepared. The Chawki reared larvae of double and control hybrid were distributed to the farmers.

A total of 11 trials of the double hybrid 'Krishnaraja' (CSR6 x CSR26) x (CSR2 x CSR27) were conducted along with the control F1 hybrid (CSR2 x CSR4) with five farmers each at Srirangapatna Taluk. A total of 1000 dfls each of double hybrid / trial were prepared and chawki reared and distributed to framers along with control F1 hybrid (CSR2 x CSR4). Required quantity (@ 6kg / 100 dfls) of disinfectants namely lime powder and bleaching powder were distributed to ten farmers for disinfection of rearing house before distribution of the chawki reared larvae Crop monitoring was carried out three times during the rearing of double hybrid and control hybrid with the farmers. The cocoons were purchased and subjected to reeling

analysis at the Institute. The reeling parameters *viz*., filament length, denier, raw silk, reelability and neatness were studied. The data of three hybrids namely Krishnaraja (CSR6 x CSR26) x (CSR2 x CSR27, single hybrid (CSR2 x CSR4) and cross breed (PM x CSR2) in respect of 12 parameters were analyzed by Kruskal-Wallis Statistical method.

Results/Discussion

There was significant improvement observed in double hybrid for most of the traits when compared with the single hybrid and cross breed. The results of double hybrid showed an improvement of cocoon yield of 19.97 and 5.27 %, cocoon weight of 1.52 and 10.48 % and shell percentage of 1.45 and 9.95% over single hybrid and cross breed. With respect to reeling traits, the double hybrid showed an improvement of raw silk percentage of 4.49 and 28.35%, filament length of 5.67 and 15.42% and neatness of 1.08 and 8.05 % as compared to single hybrid and cross breed. Moreover, the double hybrid have fetched more cocoon price / kg of cocoons and showed 12.84 and 24.91% improvement as against single hybrid and cross breed (Table 3.1).

Table 3.1: Comparative performance of the double hybrid Krishnaraja (CSR6 x CSR26) x (CSR2x CSR27), single hybrid CSR2 x CSR4 and cross breed

Hy-brid	No. of dfls	No of trials	Total cocoon yield (kg)	Yield/ 100 dfls (kg)	Cocoon weight (g)	Shell weight (g)	Shell (%)	Reela-bility (%)	Filament length (m)	Den-ier (d)	Raw Silk (%)	Neatn-ess (points)	Cocoon price /kg (Rs.)
DH	11000	11	7169.4	68.28	1.602	0.336	21.0	81	876	2.67	16.3	94	298
SH	11000	11	5976	56.91	1.578	0.327	20.7	80	829	2.58	15.6	93	264
CB	11000	11	6810.3	64.9	1.450	0.277	19.1	74	759	2.54	12.7	87	238
Kruskal – Wallis Statistic													
Hybrids	-	-	16.10	23.57	10.30	8.92	13.1	7.28	7.38	1.89	13.3	22.71	8.12
Critical value H 5.656	-	-	*	*	*	*	*	*	*	NS	*	*	*
% Improvement													
DH *vs* SH	-	-	19.97	19.98	1.52	2.75	1.45	1.25	5.67	3.49	4.49	1.08	12.84
DH *vs* CB	-	-	5.27	5.27	10.48	21.30	9.95	9.46	15.42	5.12	28.3	8.05	24.91

Mandya district, which is famous for sugarcane industry, occupies 3rd place in sericulture activities. It supports more than 40000 sericulturusts with 24000 hectares of mulberry plantation. Srirangapatna taluk of Mandya district was selected for popularization of double hybrid 'Krishnaraja'. The farmers of Srirangapatna were rearing low productive polyvoltine x bivoltine hybrid in all the seasons except during favorable season (Aug – Feb) they rear high productive bivoltine single hybrid (CSR2 x CSR4). The cross breed is popular among the sericulturists in the selected area and they rear in all seasons in their dwelling houses. The bivoltine hybrid rearing requires separate rearing house and adaptation of recommended package of practices. Hence the farmers rear polyvoltine x bivoltine hybrid which yields inferior quality silk. Ten farmers in five villages were selected for rearing of double hybrid in Srirangapatna taluk. Due to the better performance of double hybrid, crop stability to various environmental condition, higher rate / kg of double hybrid (due to superior quality of silk), more cocoon yield / kg in double hybrid, easy rearing of foundation crosses (due to hybrid vigor) have motivated the farmers of six adjacent villages in Srirangapatna Taluk for rearing double hybrids in place of cross breed.

Popularization of the double hybrid has motivated the farmers for rearing of bivoltine silkworm double hybrid in place of cross breed. As a result of the rearing of double hybrid their economy has boosted. This would in turn motivate other farmers to take up Bivoltine silkworm rearing and consequently Bivoltine cocoon production will increase there by resulting in higher production of raw silk in India.

3.2 AIB 3449: Studies on the development of indigenous method for culturing *Cordyceps* and other useful species

Kanika Trivedy (PI) and M. Munirathnam Reddy

Duration: October 2010 to September 2013

Budget: Rs.7.99 lakhs

Objective:
- To screen different spp. of *Cordyceps* and other useful species to assess its viability *in vitro* (Culture media containing pupa powder) and *in vivo* (on silkworm pupae).

Methodolgy

13 isolates of 8 different identified mycelial cultures of Ascomycetous fungi were collected from different sources indigenously. The mother mycelial cultures are being subculture and maintained in Potato dextrose agar (PDA) and Sabouraud dextrose agar yeast (SDAY) media every month and kept at 15º - 25°C for growth preferably at 20° C. Different liquid media (broth) were standardized containing different composition of chemicals and amount of *Bombyx mori* spent pupae powder or without pupae, sterilized, cooled, Inoculated culture to the prepared media. The growth of mycelia culture in broths was observed for 15 days. Broth was kept ready for the inoculation to solid media (*in vitro*) inoculation. Different solid media were prepared with different combinations of silkworm pupae, larvae, rice, barley grains, wheat, soybean media, starch *etc.,* sterilized, cooled and inoculated by culture broth or direct culture, followed by incubation at 18-28°C for 30-90 days, shaken at 80-125 rpm at 18-26°C in rotary shaker for 5 days in 2-3 days interval to produce synnemata. Specific dose of inoculum of specific cultrure was inoculated to the larvae of *Bombyx mori* at zero hour of V instar. The inoculated silkworms were reared at low temperature most preferably at 18-22°C with natural mulberry leaves until mounting of the silkworm. Infected pupae were separated and spread on wet cotton and observed for development of synnemata. Vegetative growth and fruiting bodies on pupae and solid media were recorded. The quality control of fungi was done by quantification of major bioactive constituents through HPLC against Standard Cordycepin (3'-deoxyadeosine), cordycepic acid (d-mannitol) and adenosine received from Sigma Aldrich.

Observations/Results

Thirteen isolates of 8 *Cordyceps spp. were* collected from different sources and being maintained and sub cultured 52 times as mother cultures in two different media PDA and SDAY/4. The initial colour of all the isolates were cottony white and the mycelium were of Coenocyte type. The mature colour of the mycelium was variable in the isolates which are presented in Table 3.2.

Table 3.2: Details of isolates of *Cordyceps spp.*

#	Original name	Code no.	Mature colour of mycelium
1	*Cordyceps takaomontana anamorph (Isaria tenuipies) 89*	Is 89	Cottony off white
2	*Cordyceps takaomontana anamorph (Isaria tenuipies) 90*	Is 90	Cottony off white
3	*Cordyceps takaomontana anamorph (Isaria tenuipies) 91*	Is 91	Cottony off white
4	*Cordyceps pruinosa Petch 93*	Cor Pru 93	Base dark pink,culture pinkish
5	*Cordyceps pruinosa Petch 21*	Cor Pru 21	Cottony white
6	*Cordyceps sinensis (C4 strain) 82*	Cor Sin 82	Cottony light yellow greenish small balls
7	*Cordyceps sinensis (C4 strain) 84*	Cor Sin 84	Leathery light pink
8	*Cordyceps sinensis (C4 strain)85*	Cor Sin 85	Cottony light pink small balls
9	*Elaphocordyceps ophioglossoides*	Cor Oph	Hard base black/yellow, slowest growing
10	*Elaphocordyceps gracilioides*	Cor Grac	Cottony white
11	*Cordyceps millataris*	Cor Mil	Cottony white
12	*Cordyceps subsessilium*	Cor Sub	Cottony white
13	*Elaphocordyceps japonica*	Cor Jap	Cottony white

Broths were prepared with different compositions and species specific three different compositions were finalized. Broth culture procedure was standardized. Broths were inoculated and kept in rotary shaker 98-110 rpm at 22-25°C for 5-10 days or without shaker at 22-25°C for 5-10 days. Different species showed different pattern in broth culture depending upon shaker speed.

In *in vivo,* three isolates (89, 90 & 91) of one species of fungi culture was successfully inoculated to silkworm pupae of NP, NP x ND7 and CSR 2 x CSR4 through spores. Best silkworm hybrid was CSR2 x CSR4, where 84.4-100% infection rate was recorded (Table 3.3).

Table 3.3: *In vivo* culture of *Cordyceps* in silkworm hybrid CSR2 x CSR4

Fungus Is 89, 90 & 91	No. of pupae infected	% Sprouted	Length of Synnema (mm)	No. Synnemata per pupa
89	147	88.4	25-50	80-150
90	151	100	20-25	80-120
91	35	100	40-50	6-100

Synnemata were harvested and measured. The length of each synnema (10-50 mm) along with total weight of the media and fruiting body weight were recorded. Biological efficiency (BE) was calculated for every batch of pupae and found to be 6.07-9.73 % (Table 3). After the cultures were grown in broth, they were inoculated to rice pupae media to observe its growth/ fruiting bodies in solid media. Fruiting bodies were observed in three different species - Is91, Cor Oph and Cor Pru93. Synnemata were harvested and measured in Is91. The length of each synnema in isolate 91 measured to be 30-50 mm and biological efficiency (BE) was found to be 10.18-11.04 % (Table 3.4).

Table 3.4: *In vivo* amount of fruiting body formation in Is 89, 90 & 91

Pupae batches	TW (g)	LS (mm)	TW+FW (g)	BE(%)
1	1.322	10.0	1.446	8.58
2	1.562	12.5	1.663	6.07
3	1.153	50.0	1.263	8.71
4	1.520	25.1	1.631	6.81
5	1.215	30.0	1.346	9.73
Avg	**1.354**	**25.52**	**1.470**	**7.85**

Note: BE = FW/Medium weight × 100. TW, total weight (g); LS, length of stroma (mm); FW, fruit body weight (g); BE, biological efficiency. Cor Oph grown partially *in vivo,* no fruiting body was observed.

Table 3.5: *In vitro amount* on fruitting body formation in Is 91

Age of culture (days)	TW (g)	LS (mm)	FW (g)	BE (%)
20	44.833	30.00	4.722	10.53
40	44.534	35.00	4.534	10.18
60	41.872	40.00	4.622	11.04
90	42.118	50.00	4.334	10.29
Avg	**43.339**	**38.75**	**4.553**	**10.51**

Note : BE = FW/Medium weight × 100. TW, total weight (g); LS, length of stroma (mm); FW, fruit body weight (g); BE, biological efficiency

Fruiting body of Cor oph had 2-8 cm long fruiting body, up to 1 cm wide, club-shaped, top narrower than the base, without a clearly defined "cap," but the upper portion was light cream later turned to reddish brown and smooth when young. The mycelium is yellowish wrapped around normally about 5 cm under media. The spores are thread like and segmented breaking into elliptical segments. Fruiting body was

observed in *Cor. Pru* 93. Stromata is solitary and simple with orange red colour with 2-8 x 1.3 mm head and 3-12 x 0.5-1.5 mm orange red stripe.

HPLC analysis of major bioactive constituents of *Cordyceps* - Cordycepin (3'- deoxyadeosine), cordycepic acid (d-mannitol) and adenosine of all the mycelia of *Cordyceps* cultured in the laboratory were quantified against standard. Adenosine present in all the isolates ranged from 0.345 -0.02 µg/mg. Similarly Cordycepin was present in all the isolates (0.476 -0.07 µg/mg) except Is 89, 90 & 91, whereas, Cordycepic acid present only in Cor Oph (6.48 µg/mg) and Cor Pru 93 (21.90 µg/mg) where fruiting bodies were observed. Results revealed that artificially cultured Cordyceps Oph contains 12.32 times more adenosine, almost same quantity of cordycepic acid and around 6.26 times more cordycepin as compared to naturally available *C. sinensis*.

3.3 AIP 3478: Studies of mulberry leaf nutrition on intermediary metabolism of silkworm *Bombyx mori* L.

M. Munirathnam Reddy (PI) and M. Ramesh (upto June, 2013)

Duration: April 2012 to March 2014

Budget: Rs. 7.00 lakhs

Objective:
- Correlation of mulberry leaf nutrition on intermediary metabolism and economic parameters of hybrids of silkworm *Bombyx mori* L.

Methodolgy

Two silkworm hybrids L14xCSR2 and CSR2xCSR4 were utilized to represent improved cross breed and highly productive bivoltine hybrid in the present study. Fresh mulberry leaves of V1 and S36 variety were used for feeding the larvae. The economic traits selected for the study included fecundity, weight of fifth instar larva, larval duration, single cocoon weight, single shell weight, shell percentage.

The larvae from first day of fifth instar were collected daily with a regular interval of 24h till end of fifth instar. The haemolymph was collected, the midgut and silkgland tissues were obtained from five to six larvae of fifth instar by dissecting the larvae in ice cold water. A 5% (w/v) homogenates of the tissues were prepared in pre cooled distilled water. The homogenates were centrifuged at 3000 rpm for 15 minutes. The clear supernatants were used for enzyme analysis. The haemolymph, midgut and silkgland were estimated for the following biochemical parameters. The total protein content was estimated by the method of Lowry *et al*. (1951), protease activity and free amino acid content by the method of Moore and Stein (1954) as described by Colowick and Kaplan (1957). Total Carbohydrates by Carroll *et al.* (1956), Glycogen by Montgomery (1957), the activity of Succinate dehydrogenase (SDH) was assayed by the method of Lee and Lardy (1965), total lipids by Folch *et al.* (1957) and fatty acids by Falholt *et al.* (1973) were studied.

Observations/Results

Four trials of bioassay and biochemical estimations of total proteins, free amino acids, lipids, free fatty acids, carbohydrates and glycogen in different tissues *viz,.* silk gland, mid gut and haemolymph of CSR2 x CSR4 and L14 x CSR2 silkworm hybrids were completed. Data revealed the range of cocoon weight between 1.155 and 1.745g, shell weight between 0.198 and 0.392, shell % between 18.83 and 22.48 (Table 3.6).

The cocoon weight, shell weight and shell percent were significantly high in CSR2xCSR4 hybrids fed on V1 mulberry compared to S36. Total protein and free amino acid values ranged from 28.26 to 145.5 and 32.24 to 126.84 mg/g or ml respectively. In CSR2xCSR4 haemolymph showed maximum protein and amino acid values 145.5 and 126.8 mg/ml respectively. The least values of protein and amino acids in the mid gut of L14xCSR2 were 28.26 and 32.24mg/g respectively. The range of total lipid values and free fatty acid values were observed to be 32.84 to 56.62 and 29.22 to 42.26 mg/g or ml respectively. In CSR2xCSR4 midgut showed maximum value (46.39 mg/g) and the least value was obtained in the haemolymph of L14xCSR2 (25.30 mg/ml). The total carbohydrates and glycogen were found vary from 16.43 to 58.46 and 8.12 to 16.26 µg/mg or ml respectively. In CSR2xCSR4 haemolymph showed a maximum carbohydrate and

glycogen values 58.46 and 16.26 mg/ml respectively and least values of carbohydrates and glycogen in the mid gut of L14xCSR2 were 16.43 and 8.12 mg/g respectively (Table 3.7).

Table 3.6: Rearing performance of silkworm hybrids

Race	Trial	C. wt. (g) V1	C. wt. (g) S36	Sh. wt. (g) V1	Sh. wt. (g) S36	Shell (%) V1	Shell (%) S36
CSR2xCS4	I	1.750	1.608	0.390	0.345	22.28	21.45
	II	1.740	1.652	0.394	0.356	22.68	21.54
	Avg.	1.745	1.630	0.392	0.351	22.48	21.49
	SD	± 0.071	± 0.014	± 0.017	± 0.024	± 0.064	± 0.242
L14xCSR2	I	1.330	1.106	0.254	0.182	16.47	19.09
	II	1.442	1.204	0.268	0.214	17.77	18.58
	Avg.	1.386	1.155	0.261	0.198	17.12	18.83
	SD	± 0.079	± 0.069	± 0.010	± 0.023	± 0.932	± 0.361

The maximum amino acid levels with concomitant increase in the levels of total and soluble proteins in the silk gland, haemolymph and mid gut was found in CSR2 breeds and hybrids fed on V1 mulberry leaves compared to S36. Bivoltine breeds reared on V1 variety showed maximum carbohydrates in the silkgland, haemolymph and midgut tissues when compared to S36. The results suggests the possibility that when mulberry variety V1 which is rich in protein (26.7%), carbohydrates (17.6%), are fed to silkworms, it is efficiently used for the physiological combustion and improvement in cocoon characters.

Table 3.7: Biochemical constituents in different tissues of V instar silkworm

Silkworm Race	Tissue	Mulberry Variety	Fifth instar (Range)				
			Total Proteins (mg/g or ml)	Free amino acids (mg/g or ml)	Total lipids (mg/g or ml)	Total carbo-hydrates (mg/g or ml)	Glycogen (mg/g or ml)
CSR2 X CSR4	Haemolymph	V1	43.26 -145.5	65.28 -126.8	34.66 -39.20	33.28 - 58.46	9.84-16.26
		S36	40.20 -125.4	61.56 -103.2	32.45 -38.26	30.84 - 51.54	9.24-15.28
	Mid gut	V1	32.26 -65.41	58.18 -78.01	38.82 -46.39	28.61 - 46.62	9.64-15.13
		S36	30.26 -61.14	53.78 -72.55	34.62 -42.14	24.22 - 43.36	9.02-14.16
	Silk gland	V1	63.26 -114.6	59.55 -94.42	38.61 -45.66	29.68 - 52.78	9.74-16.78
		S36	58.23 -96.56	54.99 -89.26	34.68 -44.34	26.41 - 47.98	9.34-14.68
L14 X CSR2	Haemolymph	V1	32.46 -97.84	58.65 -96.72	28.62 -36.08	25.52 - 48.24	8.92-13.08
		S36	28.26 -85.64	53.62 -89.42	25.84 -36.78	21.36 - 44.98	8.42-12.68
	Mid gut	V1	30.31 -62.64	47.72 -68.06	33.65 -40.90	20.98 - 38.29	8.72-13.68
		S36	29.87 -50.85	32.24 -60.26	30.25 -39.24	16.43 - 35.92	8.12-12.77
	Silk gland	V1	38.46 -99.05	42.92 -75.77	34.80 -40.14	24.86 - 45.16	9.22-13.65
		S36	34.63 -89.28	38.34 -69.05	30.28 -36.46	21.98 - 41.88	8.62-12.42

4. SILKWORM CROP PRODUCTION

4.1 SPR 0044: Development of silkworm rearing package for newly developed breeds/hybrids

S. Purushotham (**PI)** and D. S. Somaprakash

Duration: April 2012 to November 2013

Budget: 1.7 lakhs

Objective:
- To develop silkworm rearing package for newly developed breeds/hybrids.

Methodolgy

L14 pure breed/hybrid rearings were conducted with 200 dfls /crop (50,000 larvae/100dfls) including PM X CSR2 as control. The rearings were conducted with different spacings *viz.,* 600, 700, 800 Sq ft /100dfls and quantum of feed from 2000 to 2500 kgs of shoot and a suitable rearing package was developed for L14 breed and L14 x CSR2 hybrid. The other rearings practices like disinfection, hygiene, use of bed disinfectants as per the norms were followed during the rearings.

Observations/Results

Development of rearing package for L 14 pure breed

The L14 breed developed by the multivoltine breeding section was taken for the development of rearing package. A total quantity of 1800 dfls reared in 6 trials in all the three seasons' *i.e.,* Summer, Rainy and winter. The following observations made during the development of rearing package. The average fecundity of the breed ranged from 450 to 500 and the larval duration varied from 21 to 24 days depending on the season. The cocoon characteristics like cocoon wt (g), Shell wt (g) and Shell % were found to range from 1.260 to 1.451, 0.200 to 0.261, and 17.7 to 19.51 respectively.

Three trials of L14 pure breed rearings with 100 dfls (50,000 larvae) each with three replications was conducted with three spacings*, i.e.,* 600, 700 and 800 Sq ft /100dfls with quantum of feed from 2000, 2200 and 2500 kgs of shoot (Table 4.1). It was found that 700 Sq ft bed space with 2200 kgs of shoot feeding is optimum for seed crop rearing.

Table 4.1: Rearing performance of L14 pure breed with different spacings and quantum of feed

Rearing parameters	Bed space (sq.ft) / Quantum of feed		
Bed space (sq.ft)	600	700	800
Quantum of feed Ikg)	2000	2200	2500
Larval weight (g)	28.0	31.8	33.2
Yield/10,000 larvae by number	7824	9384	9267
Single cocoon weight (g)	1.322	1.361	1.421
Single shell weight (g)	0.241	0.256	0.262
Shell %	18.22	18.38	18.43

Development of rearing package for L 14 X CSR 2 Hybrid

L14 X CSR 2 hybrid rearing with three replications and three spacings, *viz.,* 700, 800 and 1000 Sq.ft with the quantum of feed from 2200, 2600 and 2800 kgs of shoot was carried out (Table 4.2). The results clearly showed that the performance of the hybrid is optimum with 800 Sq ft bed space with 2600 kgs of shoot feeding. The cocoons generated from the said hybrid were sent to reeling section for analysis of post cocoon characters which revealed that the silk produced is of 2A grade.

Table 4.2: Rearing performance of L14 x CSR2 hybrid with different spacings and quantum of feed

Rearing parameters	Bed space (sq.ft) per Quantum of feed		
Bed space (sq.ft)	700	800	1000
Quantum of feed (kg)	2200	2600	2800
Larval weight (g)	42.0	46.0	48.0
Yield/10,000 larvae by number	9022	9581	9255
Single cocoon weight (g)	1.980	2.098	2.050
Single shell weight (g)	0.393	0.427	0.412
Shell %	19.84	20.34	20.09

Rearing package developed for L14 breed and hybrid will be provided to the seed rearers as well as commercial hybrid rearers for harvesting good cocoon crops.

4.2 SPR 0041: Large scale multiplication of new multivoltine and bivoltine breed/hybrids

D. S. Somaprakash (**PI)** and S. Purushotham

Duration: April 2012 to November 2013

Budget: 1.7 lakhs

Objective:
- Large scale multiplication of multivoltine breed L14.

Methodology

The layings of newly developed breeds and hybrids developed by the breeding laboratories were evaluated in large scale under standard rearing conditions. During the rearing period all the rearing parameters like hatching percentage, weight of matured larvae, larval duration ERR/10,000 larvae, yeild/100dfls, single cocoon weight, shell weight, shell percentage and pupation rate were recorded.

Observations/Results

Six rearing trials of L14 pure breed were conducted during summer (3 trials with 700 dfls), rainy (one trial with 100 dfls) and winter (2 trials with 400 dfls) seasons. The rearing performance is shown in Table 4.3.

Table 4.3: Large scale rearing performance of L14 breed

Season	ERR		Cocoon weight (g)	Shell weight (g)	Shell percentage (%)
	No.	Wt. (kg)			
Summer	5126	5.54	1.260	0.236	18.67
Rainy	9668	13.81	1.431	0.270	18.62
Winter	9446	12.14	1.319	0.253	19.19

A total of 5.08 lakh P1 seed cocoons were generated which were utilized for preparation of F1 layings under pre- race authorization programme of L14 X CSR 2 for further field evaluation.

Further, 50 dfls each of L14 x CSR2 and PM x CSR2 (control) were reared and was evaluated. The new hybrid was found to be superior in terms of cocoon yield and cocoon traits (Table 4.4).

Table 4.4: Rearing performance of L14 x CSR2 and PM x CSR2

Race	Yeild / 100 dfls (kg)	ERR		Cocoon weight (g)	Shell wt. (g)	Shell percentage (%)
		No.	Wt. (kg)			
L14 x CSR2	76.4	9561	19.75	2.099	0.427	20.34
PM x CSR2	73.4	9581	17.56	1.895	0.337	17.78
% Improvement over control	4.08	-0.20	12.47	10.70	26.70	14.39

5. SILKWORM CROP PROTECTION

5.1 PPE 3455: Habitat studies:- Impact of crop diversity on the conservation and performance of natural enemies in mulberry eco-system

J. B. Narendra Kumar (PI), B. T. Sreenivas, V. B. Mathur, Noble Morrison, R. Gururaj and A. Meenal

Duration: September 2011 to February 2014

Budget: Rs. 2.5 lakhs

Objective:

- To determine the occurrence of insect pests and abundance of natural enemies in mulberry eco-system under irrigated, semi-irrigated and rain-fed conditions in relation to other crops grown in the vicinity.

Methodology

For the study Haleboodanur, Kattedoddi, B.Yeralli, Mallayyanadoddi and Thoreshettahalli villages are selected in Irrigated region of Mandya district. The crop diversities followed are mulberry gardens surrounded by sugarcane and paddy. Karenahalli, Kyalanoor, Raghupathi Agrahara, Ithandanahalli & Kondenahalli villages are selected in Semi-Irrigated region of Kolar district under the mulberry gardens surrounded by Tomato/vegetables, & Marigold Crop diversities. Like wise Kalpura & Mailajipura villages are selected in rain fed region of Chamarajanagar district under the mulberry gardens surrounded mixed crop species crop diversities. In all the above regions, mulberry gardens surrounded by mulberry were considered as control.

Data on the incidence of major mulberry pests were collected at regular monthly intervals in five gardens under each crop diversity (a total of 40 mulberry gardens from 3 districts). Similarly abundance of natural enemies available in 100 plants in each of the above 40 mulberry gardens was also recorded. Released known number of predatory lady bird beetles in each of the habitat and recorded the recovery percentage of the same after 40-45 days of release. Data were compiled and tabulated to draw inference.

Observations/Results

The monthly survey data on the incidence of available insect pests of mulberry in the 3 districts is tabulated at Table 5.1. It is observed that number of insect pests were as high as 13 each in both irrigated & rain fed mulberry gardens of Mandya & Chamarajanagar district whereas in semi-irrigated district of Kolar it was 10 (Table 5.1). In the irrigated mulberry gardens, a new species of white fly, *Dialeuropora decempuncta* as well as a new coleopteran pest *Oberea artocarpi* (Cerambycidae) have been recorded to be posing threat. Also, in Thoreshettahalli, only in one mulberry garden millipedes (a non-insect) were found damaging mulberry branches at abscission zone and also feeding on tender leaves, especially during rainy season. In the semi-irrigated region of Kolar district, weevils are causing damage to mulberry foliage and may pose as a threat in future. After pruning of mulberry, they were found to be harbouring neem and another weed plant.

Table 5.1: Insect pests recorded in the mulberry gardens of three selected districts

Sl.No.	Mulberry Pests	Mandya (Irrigated)	Kolar (Semi-irrigated)	Chamarajanagar (Rain fed)
1	*Maconellicoccus hirsutus* (Homoptera: Pseudoccidae)	++	++	+
2	*Paracoccus marginatus* (Homoptera: Pseudoccidae)	+	--	+
3	*Diaphania pulverulentalis* (Lepidoptera: Pyralidae)	+++	+++	+
4	*Pseudodendrothrips mori* (Thysanoptera: Thripidae)	++	+++	+
5	*Spilarctia obliqua* (Lepidoptera: Noctuidae)	++	+	+
6	*Aleurodicus dispersus* (Homoptera: Aleyrodidae)	+	+	+

7	*Dialeuropora decempuncta* (Homoptera: Aleyrodidae)	+++	--	--
8	*Empoasca flavescens* (Homoptera: Cicadellidae)	+	+	+
9	*Saissetia nigra* (Homoptera: Coccidae)	+	+	++
10	*Neorthacris nilgiriensis* (Orthoptera: Acrididae)	++	+	++
11	*Myllocerus* sp. (Coleoptera: Curculionidae)	+	++	+
12	*Odontotermes* sp. (Isoptera: Termitidae)	--	--	+++
13	*Holotrichia serrata* (Coleoptera: Melolonthidae)	++	++	+
14	*Apriona* sp. (Coleoptera: Cerambycidae)	--	--	+
15	*Oberea artocarpi* (Coleoptera: Cerambycidae)	++	--	+
	Total No.	**13**	**10**	**13**

(-- =Absent; + = Less than 5%; ++ = Moderate or 6-10%; +++ = Severe or above 10%)

The monthly survey data on the natural enemies in the mulberry eco-system in the 3 districts is tabulated at Table 5.2. It is revealed that total number of natural enemies available were more (12 species) in irrigated gardens followed by semi-irrigated (9) and least (4) in rain fed gardens (Table 5.2). It was observed that *Acerophagus papayae* is very well establised in both irrigated & rain fed regions and effectively checking the further spread of the exotic pest, papaya mealybug. The mealy bug destroyer, *Cryptolaemus montrouzieri* was not found in rain fed mulberry gardens, but though available in both irrigated & semi-irrigated gardens, not very much abundant.

Table 5.2: Natural enemies observed in the mulberry gardens of three selected districts

Sl.No.	Natural Enemies	Mandya (Irrigated)	Kolar (Semi-irrigated)	Chamarajanagar (Rain fed)
1	*Menochilus sexmaculatus* (Coleoptera : Coccinellidae)	√	√	√
2	*Cryptolaemus montrouzieri* (Coleoptera: Coccinellidae)	√	√	**x**
3	*Scymnus coccivora* (Coleoptera : Coccinellidae)	√	√	√
4	*Ilies* sp. (Coleoptera : Coccinellidae)	√	√	√
5	*Brumoides suturalis* (Coleoptera : Coccinellidae)	√	√	**x**
6	*Chilochorus nigritus* (Coleoptera : Coccinellidae)	√	**x**	**x**
7	Anthocoreid bug (hemiptera: Anthocoreidae)	√	√	**x**
8	*Geocoris* sp. (Hemiptera: Geocoreidae)	**x**	√	**x**
9	*Apanteles bisulcata* (Hymenoptera: Apantelidae)	√	**x**	**x**
10	*Ichneumonid* (Hymenoptera: Ichneumonidae)	√	√	**x**
11	*Acerophagus papayae* (Hymenoptera: Encyrtidae)	√	**x**	√
12	*Mallada* sp.(Neuroptera: Chrysopidae)	√	**x**	**x**
13	*Micromus* sp.(Neuroptera: Hemerobidae)	√	**x**	**x**
14	Predatory mites (Class: Arachnida)	**x**	√	**x**
	Total No.	**12**	**9**	**4**

(√ = Present; x = Absent)

The data collected under irrigated condition in Mandya district, semi-irrigated mulberry gardens of Kolar district and also in the rain fed mulberry gardens of Chamarajanagar revealed that the incidence of major mulberry pests and natural enemies did not vary significantly between the crop diversities.

It was observed that crop diversity had relationship with the recovery of predatory coccinellid beetles (Table 5.3). Under irrigated condition, in control gardens recovery was highest (472.8%) followed by Mulberry:Sugarcane (416.8%) and Mulberry:paddy (352.6%). Under semi-irrigated condition, recovery was almost on-par between control gardens and Mulberry: marigold (430.4 & 428.6% respectively), whereas in mulberry: Tomato system, it was very less (280.4). Under rain fed condition, recovery was highest in Mulberry: Mixed crop gardens (488.8%), followed by control gardens (315.4%).

Table 5.3: Recovery of predatory beetles (%) in various crop diversities under irrigarted, semi-irrigated & rain fed conditions (Average of 3 Trials)

Region	Treatment & Crop diversity	Recovery (%)	Rank of treatment
	T1: Mulberry:Sugarcane	416.80^{BC}	5
Mandya	T2: Mulberry : Paddy	352.60^{CD}	6
(Irrigated)	C1: Mulberry : Mulberry (control)	472.80^{AB}	2
	T3: Mulberry : Tomato	280.40^{E}	8
Kolar	T4: Mulberry : Marigold	428.60^{AB}	4
(Semi-Irrigated)	C2: Mulberry : Mulberry (control)	430.40^{AB}	3
Ch'nagar	T5: Mulberry : Mixed Crop	488.80^{A}	1
(Rainfed)	C3: Mulberry : Mulberry (control)	315.40^{DE}	7
General Mean	-	398.23	.
p-Value	-	<.0001	.
CV (%)	-	13.35	.
SE (d)	-	33.629	.
LSD at 5%	-	68.886	.

Note: Means with atleast one letter common are not statistically significant using Fisher's Least Significant Difference.

It is a general phenomenon that increased botanical diversity reduces pest problems and enhances impact of natural enemies. Although several hypothetical explanations have been suggested, the mechanism behind the positive effects of mixed cropping are still only partly understood. In sericulture, along with mulberry several other crops are also existing in their vicinity and hence there was a felt need to study their impact on the pest incidence and abundance of natural enemies. The present study has revealed that adjacent crops such as sugarcane, paddy (under irrigated condition), tomato, marigold (under semi-irrigated condition) and mixed crop species (under rain fed condition) are not having any impact on the incidence of insect pests on mulberry. The literature available on this type of study with respect to mulberry is seanty. However the crops in the vicinity have great impact on proliferation and multiplication of coccinellid predators like *Scymnus coccivora.* This is evident from the data collected on the counts of natural enemies under this study.

Crop Diversities Selected for the Study

Irrigated condition of Mandya district

Mulberry : Sugarcane

Mulberry : Paddy

Semi-Irrigated condition of Kolar district

Mulberry : Tomato

Mulberry : Marigold

Rain fed condition of Chamarajanagar district

Mulberry : Sorghum, Cowpea

Mulberry: Castor, Cotton

5.2 PRE 3467: Evaluation of available management strategies of giant African snail, *Achatina fulica* Bowdich in mulberry eco-system

B. T. Sreenivas (PI), J. B. Narendra Kumar, M. R. Subrahmanyam and Pratheesh Kumar

Duration: April 2012 to February 2014

Budget: Rs. 1.5 lakhs

Objectives:

- To monitor snail population in hot spot area and estimation of mulberry leaf yield loss.
- Identify suitable mechanical and chemical methods for the management of giant African Snail in mulberry crop system.
- Determine the safe period of the effective chemicals (to silkworms) used in management of giant African Snail.

Methodology

Snail incidence was recorded in 5 mulberry gardens each in 2 hot spot areas of Ramanagar and Kanakapura at fortnightly interval in 1 m x 1 m quadrant at 5 random places in each plot. In order to estimate the leaf yield loss, total bio-mass of randomly selected 10 each of infested & non-infested mulberry plants was recorded. To find out the most preferred attractant plant material for hiding by the snails, papaya stem waste, cabbage and mulberry shoots were evaluated in an isolation chamber of size 10' x 30' with established mulberry plants having 3ft x 3 ft spacing along with control.

The Bio-formulations such as *Aeromonas Salmonicida* and *A. hydrophila* (*8* x 10^7 cells/ml diluted in distilled water), two botanicals namely Navinya (10g/lit) and *Artemisia absinth* (10g dry leaves powder dissolved in 1 lit water) were evaluated for their efficacy in killing the snails. The observation on the mortality was recorded at 5 days interval up to 30 days. With regard to chemicals, the Molluscide, 2.5% Metaldehyde, baits of Dichlorvos (250 ml with 200g fermented Jaggary and 1000g wheat floor) and Methomil (10g chemical with 200g jaggery and 400 ml water) were evaluated against snails.

Safety of most effective chemical *i.e.,* Metaldehyde was determined against silkworm by direct contact (8-10 pellets per 100 silkworms in a plastic rearing tray of size 14" x 8") as well as by feeding the leaves harvested from mulberry plants applied with Metaldehyde pellets to silkworm from 1^{st} instar onwards. The mortality of silkworms was recorded at daily interval. Field trial with most effective chemical *i.e.,* Metaldehyde was conducted at Chikkereyur (H. D. Kote area) & Kuttipalyam (Gobi area) by placing Metaldehyde pellets @ 2kg/acre infested garden in the evening hours with moist soil condition. The % mortality of snail was recorded after 24 h of treatment.

Observations/Results

Bench mark survey conducted during Nov-Dec 2011 in the hot spot area of Ramanagar and Kanakapura area revealed an average snail incidence of 37.8%. However, during the project period, no snail incidence was reported from the selected mulberry gardens in the above area. A leaf yield loss of 10.26% was recorded during September 2013 in H. D. Kote area.

Under mechanical methods, various trapping materials were evaluated which revealed that highly attracting material for snail was papaya stem waste followed by mulberry shoots with least preference for cabbage. Hence papaya stem waste can be used for trapping the snails in the mulberry gardens, in the absence of which mulberry shoots can be used.

The Bio-formulations such as *Aeromonas Salmonicida* & *A. hydrophila* were evaluated for their efficacy in killing the snails. On spraying *A. salmonicida* with a dilution of $8x10^7$ cells/ml, till 15 days no mortality was recorded. However, 60%, 80% and 96.7% mortality was observed after 20, 25 & 30 days after treatment respectively. With regard to *A hydrophila,* no mortality was observed. The two botanicals namely Navinya and *Artemisia absinth* had no effect on snails.

With regard to chemicals, the Molluscide, 2.5% Metaldehyde, baits of Dichlorvos and Methomil (40 SP) were evaluated against snails. Among the above 3 chemicals, Metaldehyde was found to be more

effective (Table 5.4). Metaldehyde caused a mortality of 70% 2 days after treatment and 100% mortality 4 days after treatment.

Table 5.4: Laboratory Evaluation of chemicals against snails (Av. of 3 trials)

Treatment	**% Mortality (day-wise)**					
	Day-1	**Day-2**	**Day-3**	**Day-4**	**Day-6**	**Day-7**
Metaldehyde	6.67	70.00	95.56	100	100	100
Control	0	0	0	0	0	0
Dichlorvos	0	3.33	57.78	78.89	87.78	96.67
Control	0	0	0	0	0	0
Methomil	0	1.11	6.67	43.33	58.89	75.56
Control	0	0	0	0	0	0

The field trials with application of Metaldehyde were conducted at Chikkereyur (H. D. Kote Taluk) and Kuttipalyam (Gobi-Tamil Nadu) and the suppression of snails recorded were 90.25 and 87.9% respectively (Tables 5.5; 5.6).

Table 5.5: Field trial with Metaldehyde for snail control at Chikkereyur village in H. D. Kote Taluk

Sl. No	**Name of the farmers & village**	**Mulberry acreage (ac)**	**Snail population/50 plants (Before Tr)**	**Live snails/50 plants (24h After Tr)**	**Suppression (%)**
1	Rangaswamy	1.5	410	38	90.7
2	Mahadevaiah	1.0	554	54	90.2
3	Jayamma	1.5	432	44	89.8
	Total/Av	**4.0**	**1396**	**136**	**90.25**

Table 5.6: Field trial with Metaldehyde for snail control at Kuttipalyam, Tamil Nadu

Sl. No	**Name of the farmers & village**	**Mulberry acreage (ac)**	**Snail population/50 plants (Before Tr)**	**Live snails/50 plants (24 h After Tr)**	**Suppression (%)**
1	Andavar	2	961	122	87.3
2	Armugam	2	1352	137	89.8
3	Thangamani	2	1026	119	88.4
4	Chandramohan	2	1289	172	86.6
5	Nataraj	2	1197	150	87.5
	Total/Av	**10**	**1165**	**140**	**87.9**

Bio-assay studies of bio-formulations and chemicals for the safety of silkworms were carried out. When silkworms were orally fed with mulberry leaves sprayed with bio-formulations such as *Aeromonas salmonicida, A. hydrophila,* Navinya *&* a botanical, *Artimisia absinth,* no mortality was recorded. When Bio-assay with 2.5% Metaldehyde used no mortality of silkworm was recorded on feeding the mulberry leaves harvested from mulberry plants applied with Metaldehyde pellets as well by direct contact of Metaldehyde with silkworms. Papaya stem waste can be used in the mulberry gardens to trap & destroy the snails. Two kg Metaldehyde pellets are required to be spread in one acre of mulberry garden in alternate rows during evening hours in rainy season for effective snail management. Metaldehyde pellets can also be placed in hiding places of snails, compost pits, dumping yards for suppression of snail population. Metaldehyde was found safe to silkworms.

Snail culture maintained in Lab

Stem girdling by snails

Safety of Metaldehyde to silkworms

Bio-assay studies

Snail mortality due to *A. salmonicida*

Snail mortality due to Metaldehyde

5.3 MPT 0049: Detection of virus in mulberry in hot spot area of Karnataka- A pilot study

Mary Josepha (PI) and Vinod Kumar

Duration: February 2013 to March 2014

Budget: Rs. 0.75 lakhs

Objective:

- To determine the nature of viral type symptom in mulberry.

Methodology

Survey was conducted in the hot spot area of Kanakapura and samples were collected. Mulberry plots in CSRTI, Mysore were screened and plants having viral type symptoms were collected. Cuttings collected from Kanakapura and CSRTI in pots were planted and infected plants were uprooted and planted in net house after cutting the branches. A total of 30 healthy V1 plants were raised in pots for grafting studies. Bud grafting was done from healthy to infected plants and *vice versa*.

Observations/Results

Of the uprooted plants directly planted, all the three plants in the first batch expressed symptoms like stunted growth, spots, fasciation of the stem, round and smaller leaves etc., whereas in the second batch only 1 plant expressed symptoms. After third pruning also these plants developed symptoms. Five plants collected from CSRTI did not develop any symptom. The cuttings collected from symptom expressed plants showed 22.5% survivability. The established plants developed from these cuttings expressed symptoms like leaf texture change, mosaic, broken ring, cupping, curling and puckering. The buds taken from plants having different symptoms, expressed symptoms after development. The buds grafted on healthy plants which were

taken from the plants collected form Kanakapura showing stunted growth; spots, puckering, fasciation etc., developed the same symptoms after development. The healthy buds developed in the plants were removed to develop the grafted bud only. Second plant grafted with buds collected from mosaic expressed plants also developed puckering and leaf texture change. Results indicated that the causative agent of the disease is present in the plant and it is systemic. The isolation and identification of the causative agent has to be done to study the mode of the spread of disease and for its effective management Figs. 5.1 & 5.2).

Fig. 5.1: Plants showing shape change and Yellow streaks yellow spots

Fig. 5.2: Symptoms developed in the bud grafted plants

5.4 SPT 0024: Maintenance of silkworm pathogens and testing their virulence at periodical intervals

M. Balavenkatasubbaiah (PI), K. Chandrasekharan and A. R. Narasimha Nayaka

Duration: July 2010 to June 2013

Budget: 2.00 lakhs

Objectives:
- To multiply and maintain the various silkworm pathogens in pure culture forms.
- To assess the virulence and pathogencity of the pathogens periodically.

Methodology

Isolation and purification of BmNPV polyhedra as per Sugimori *et al.* (1990) and Sowmyashree (2011) and virulence test by bioassay. Isolation and purification of BmIFV and BmDNV by Nakagaki *et al*. (1987) and Sato (1992) and multiplication and virulence test by bioassay. Isolation and culture of *Bacillus thuringiensis* as per Samson (1987) and virulence test by bioassay on silkworm. Isolation and culture of *Streptococcus faecalis* and *Staphylococcus aureus* as per Selvakumar (2003) and virulence test by bioassay on silkworm. Isolation and culture of *Beauveria bassiana* and *Spicaria prassina* by standard method using Sabouraud dextrose agar (Nataraju *et al*., 2005) and virulence test by bioassay on silkworm. Isolation and culture of *Aspergillus flavus* and *Aspergillus tamarii* by standard method using potato dextrose agar/Czapek Dox agar (Govindan and Devaiah, 1995) and virulence test by bioassay on silkworm. Isolation and purification of *Nosema bombycis* and other microsporidia by Sato and Watanabe (1980) method and virulence test by bioassay.

Observations

Pure stocks of viral pathogens *viz*., BmNPV, BmIFV, BmDNV, bacterial pathogens *viz*., *Streptococcus* sp., *Staphylococcus* sp. and *Bacillus thuringiensis*, Fungal pathogens *viz., Beauveria. bassiana*, *Spicaria prassina*, *Aspergillus tamarii* and *Aspergillus flavus* and different microsporidia *viz*., NIK-1Bm, NIK-2Bm, NIK–3Bm, NIK–4Bm, NIK–5Bm and NIK–6Bm were maintained. Tested the virulence of these pathogens to silkworms at periodic intervals in different concentrations and they were found virulent to silkworms. Mortality/infection recorded in silkworms in all the tested pathogens. The mortality/infection increased as the concentration of pathogen increased. All the tested pathogens *viz.*, BmNPV, BmIFV, BmDNV, *Streptococcus* sp., *Staphylococcus* sp. and *Bacillus thuringiensis, Beauveria bassiana, Spicaria prassina*, *Aspergillus tamarii, Aspergillus flavus* and different microspordia *viz*., NIK-1Bm, NIK-2Bm, NIK–3Bm, NIK–4Bm, NIK–5Bm and NIK–6Bm are found virulent to silkworms and are being maintained in pure forms.

5.5 SPT 0045A: Identification of probiotic bacteria from the mulberry silkworm and study their antibacterial activity against the bacterial pathogens of silkworm, *Bombyx mori* L.

K. Chandrsekharan (PI) (upto May 2013), **A. V. Mary Josepha (PI)** (from August 2013), M. Balavenkatasubbaiah and A. R. Narasimha Nayaka

Duration: October 2012 to March 2014

Budget: 1.50 lakhs

Objectives:

- Isolation of probiotic bacteria from mulberry silkworm.
- Testing the antibacterial activity of the isolated probiotic bacteria against the bacterial pathogens of silkworm by *in vitro* method.

Methodology

Isolated one probiotic bacteria from the midgut of mulberry silkworm and maintained the pure culture of the bacteria for experimental purpose. Identified the isolated probiotic bacteria. Tested anti-bacterial activity of the probiotic bacteria against the bacterial pathogens of mulberry silkworm *viz.,* Bacillus *thuringiensis*, *Streptococcus* sp. and *Staphylococcus* sp. by *in vitro* method (Fleming *et al*., 1985 and Schillinger and Luke 1989). The antibacterial activity of the isolate was tested using different methods like well diffusion method and disc method. Finally, standardized the agar spot method as per Fleming *et al*., 1985 and Schillinger and Luke, 1989. Inhibition was scored positive if the width of the clear zone around the colonies of the isolates bacteria was 0.5 mm or larger. Tested the anti bacterial activity of four known probiotic bacteria collected against the bacterial pathogens of mulberry silkworm *viz., Bacillus thuringiensis*, *Streptococcus* sp. and *Staphylococcus* sp by *in vitro* method as above.

Observations

Isolated one non pathogenic bacterium from the midgut of silkworm (Figs. 5.3 & 5.4). The isolate was maintained in pure form and the culture revived regularly. The isolate is a *Bacillus* sp. The isolate has antagonistic activity against *Bacillus thuringiensis* of mulberry silkworm *Bombyx mori* L. Average radius of the zone was 0.86 cm (Fig. 5.5) The antibacterial activity of four known probiotic bacteria, *Streptococcus noursei, Lactobacillus acidophilus, Lactobacillus plantarium* and *Bacillus subtilis* were also tested against the bacterial pathogens of silkworm *viz., Bacillus thuringiensis*, *Streptococcus* sp. and *Staphylococcus* sp, of this *Bacillus subtilis* possess antagonistic activity against *Bacillus thuringiensis* (average radius of the zone 0.5 cm) and *Streptococcus* sp. (average radius of the zone 0.75 cm) of mulberry silkworm, *Bombyx mori* L. (Figs. 5.6; 5.7 & 5.8). Results indicated that the isolated pro biotic bacterium has antagonistic activity against *Bacillus thuringiensis* of mulberry silkworm. *Bacillus subtilis* a known probioitic bacterium also has antagonistic activity against *B. thuringiensis* and *Streptococcus* sp. of mulberry silkworm. These two bacteria can be tested *in vivo* to study their role in controlling bacterial diseases of mulberry silkworm after studying their compatibility.

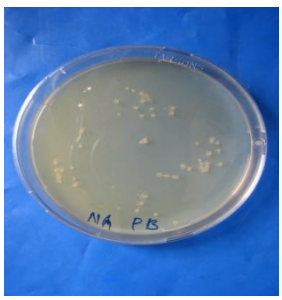


Fig. 5.3: The probiotic bacteria isolate from silkworm

Fig. 5.4: The probiotic bacteria isolate from silkworm

Fig. 5.5: Antibacterial activity of the isolate against *B. thuringiensis*

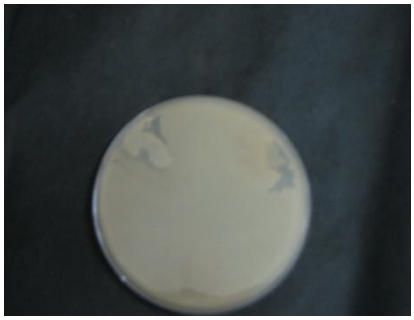


Fig. 5.6: Clear zone formed around the *B. subtilis* colony against *B. thuringiensis*

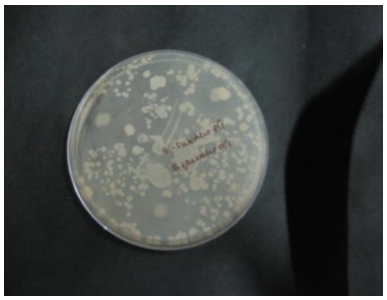


Fig. 5.7 & Fig. 5.8: Clear zone formation around the *B. subtilis* colony denotes its antagonistic action against the *S. faecalis*

6. SERICULTURE EXTENSION

6.1 MOE 3458: A Study on adoption of pest and disease management strategies in Sericulture

B. Gangadhar (PI), M. R Subrahmanyam, T. Mogili, T. Thirunavukkarasu and G. S. Geetha

Duration: October 2012 to March 2014

Budget: 1.17 lakhs

Objectives:

- To estimate the extent of damage caused by different pests and diseases on mulberry and silkworm.
- To determine adoption level of management practices for the pests and diseases of mulberry as well as silkworm.
- To investigate the impact of key personal psychological, socio-economic and institutional factors on adoption of pest and disease management practices.
- To document constraints faced by the farmers in adoption of pest and disease management practices.

Methodology

The study was conducted in three states *viz.,* Ramanagaram district of Karnataka, Chittoor district of Andhra Pradesh and Erode district of Tamil Nadu. This was done with designed questionnaire by covering randomly selected 300 sericulturists covering 100 each sericulturists spread over 70 villages in Tamil Nadu, 75 villages in Karnataka and 50 villages in Andhra Pradesh respectively. In the study, the level of adoption of technologies in sericulture was collected by the interview method with the help of pre-structured questionnaire to get the information on adoption of IDM of leaf spot, leaf rust, powdery mildew, root-knot and root-rot diseases and IPM of mulberry pest like pink mealy bug, papaya mealy bug, leaf roller, thrips, Bihar hairy caterpillar and cutworm and the silkworm disease like grasserie, flacherie and muscardine and silkworm disease and pest of uzi fly. The information was also collected on the socio-economic status,

knowledge level of farmers on mulberry diseases, mulberry pests, silkworm diseases and pest, decision making with respect to their control and adoption of Integrated pest Management (IPM) packages.

Observations/Results

The adoption level of ITP under mulberry disease including mechanical, chemical and biological control measures were fully adopted by 82.0% in Andhra Pradesh and 81.0% adoption in Karnataka. The extent of adoption was highest at 84.0% in case of Tamil Nadu. Adoption level of mulberry pest was at an extent of 86.00%, 83.0% and 81.0 % in case of Tamil Nadu, Andhra Pradesh and Karnataka, respectively (Table 6.1).

Table 6.1: Adoption level of Integrated Technology Package of mulberry disease and Pest (%)

Adoption level	Andhra Pradesh	Karnataka	Tamil Nadu
I. Mulberry diseases			
Full adoption	82.0	81.0	84.0
No adoption	18.0	19.0	16.0
II. Mulberry pest			
Full adoption	83.0	81. 0	86.0
No adoption	17.0	19.0	14.0

Adoption level of silkworm disease including flacherie, grasserie and muscardine were recorded at an extent of 88.0% in Andhra Pradesh, 85.0% in Karnataka and 89.0% in Tamil Nadu. The extent of adoption of ITP for pest including exclusive method, physical method and biological method were 85.0% full adoption in Andhra Pradesh, while the same was 84.0% in Karnataka and 88.0% in Tamil Nadu (Table 6.2).

Table 6.2: Adoption level of Integrated Technology package of silkworm disease and pest (%)

Adoption level	Andhra Pradesh	Karnataka	Tamil Nadu
I. Silkworm disease			
Full adoption	88.0	85.0	89.0
No adoption	12.0	15.0	11.0
II. Silkworm pest			
Full adoption	85. 0	84..0	88.0
No adoption	15.0	16.0	12.0

After adoption of technology packages, there was substantial increase in productivity of mulberry leading to increase in the intake of dfls, cocoon yield and income generation in all the three states (Table 6.3).

Table 6.3: Over all Impact of adoption level of disease and pest package on cocoon yield (acre/year)

Economic parameters	Andhra Pradesh		Karnataka		Tamil Nadu	
	Before adoption	After adoption	Before adoption	After adoption	Before adoption	After adoption
Total Dfls reared /acre /year	900	1185	925	1155	850	1100
Avg. cocoon yield-kg / 100 dfl	63.50	65.85	58.50	62.00	65.00	70.00
Avg. Rate/kg	286.00	330.00	280.00	300.00	295.00	365.00
Income per year /acre Rs.	163449	257506	151515	214883	162987	281050

Reasons for low adoption of technologies

Majority of the sericulturists expressed non-availability of bio-control agents in time, which act as major constraints for adoption of IPM practices (35.3%). Majority of the farmers expressed that neighbor hood farmers have not given good impact of technology immediately after adoption (12.7%). About 14 %

farmers expressed that lack of knowledge about bio-control agents. Some farmers expressed that it is difficult to use bio-control agents every crop period and hence it is difficult to adopt (31.7%). Majority of the farmers expressed awareness about the bio-control agent practices but not conferred (44.0%). Some of sericulturists stated that high cost of bio-control agents (29.3%) is also a constraint and requested for release of bio-control agents by the Institutes / offices free of cost in the area.

The study on the adoption level of knowledge and the perception of the farmers on the occurrence of disease and pest and their management practices revealed that the farmers are aware majority of the harmful pest of mulberry and silkworm. Most of the farmers were aware of the bio-control agents as well as IPM of silkworm pest. The major constraints were found to be non-availability of the in puts / bio-control agents. Most of the farmers opined that they wanted the Institute or DoS to arrange supply of the bio-control agents at lower or free of cost and to the place where there is existing crop. Though the farmers were well aware of the insect pests of mulberry and silkworm, they were lacking in the technical know how about the IPM. It is necessary to educate the farmers on IPM practices in mulberry and silkworm and its effectiveness in suppressing the pest population.

7. REGIONAL SERICULTURAL RESEARCH STATION, SALEM

7.1 SEM(S) 8001: Studies on adoption of Silkworm disease control measures and its impact on cocoon production in farmers' field under Tamil Nadu conditions

C. A. Mary Flora (PI) and R. Balakrishna (upto June 2013)

Duration: June 2010 to June 2013

Budget: 0.48 lakhs

Objectives:

- To find out the knowledge level of sericulturists about the recommended silkworm disease control measures.
- To find out the extent of adoption of recommended silkworm disease control measures.
- To identify and evaluate the factors/constraints affecting the adoption level of silkworm disease control measures.

Methodology

The study was made by covering a sample of 70 farmers each from Namakkal and Salem districts to know the adoption level of silkworm disease control measures. The package of practices of silkworm disease control measures published by CSRTI, Mysore was taken as the recommended packages of silkworm disease control measures. Based on relevance and inter-relationship, as many as 25 recommended silkworm disease control measures / technologies were further grouped into following five technology packages to study the overall awareness and adoption level. Silkworm disease prevention technology, Disease Control measures in silkworm rearing, Disinfection and Hygiene maintenance during silkworm rearing, Disease management practices under low temperature and high humidity conditions and Disease management practices under high temperature and low humidity conditions. The data was collected through interview method with a pre-structured questionnaire. The Simple Percentage analysis was used for the study based on the objectives.

Observations/Results

The results obtained on knowledge level and adoption level for different technology packages are indicated in table 7.1 &7.2.

Table 7.1: Knowledge level of silkworm disease control measures among farmers of Salem and Namakkal Districts

Technology	Knowledge (%)					
	Salem			Namakkal		
	Full	Partial	No	Full	Partial	No
I	81.00	14.33	4.67	78.00	14.00	8.00
II	75.33	24.67	0	65.00	35.00	0
III	55.20	44.80	0	36.20	63.60	0
IV	73.15	26.86	0	64.85	33.15	2.00
V	64.14	35.86	0	61.15	38.14	0.71

Table 7.2: Adoption level of silkworm disease control measures among farmers of Salem and Namakkal Districts

Technology	Adoption Level (%)					
	Salem			Namakkal		
	Full	Partial	No	Full	Partial	No
I	77.34	21.33	1.33	87.33	12.67	0
II	60.33	39.67	0	56.67	43.33	0
III	15.20	76.40	8.40	10.20	82.20	7.6
IV	51.28	40.86	7.86	55.29	38.00	6.71
V	55.43	36.71	7.86	48.57	47.29	4.14

The study indicates that, the knowledge and adoption of disinfection and hygiene in silkworm rearing is poor in both the districts. Use of bed disinfectants as per recommendations and handling of diseased silkworm etc., are the poorly adopted technology components. Further, the season specific disease management practices are also poorly adopted by the farmers. The adoption level is more with big farmers followed by medium and small farmers. The major reasons for partial/ non adoption of some technologies as expressed by farmers were lack of detailed knowledge about silkworm disease control measures, high cost of technology materials, health hazards encountered by use of disinfectants, traditional practices and non-experience of negative effects by partial/no adoption of certain technologies. The farmers who adopted the silkworm disease control measures to a maximum level experienced continuous crop success and stability and they are rearing bivoltine throughout the year and some of them have already switched over to bivoltine seed crop rearing. Hence, it is important to identify the poor adopters and import suitable training to make them aware about silkworm disease control measures besides conducting frequent field demonstrations.

In order to increase the adoption level of silkworm disease control measures, the progressive farmers have to be identified and by keeping them as models, other farmers should be motivated to adopt the technologies. To create awareness on the technology components, the farmers must be educated about the benefits/ advantages of the technologies through handouts/bulletins/pamphlets, demonstration of technologies, training etc.

7.2 MPT (S) 8002: Studies on rhizosphere microflora of mulberry varieties as influenced by different cultivation practices under alkaline condition

N. Dhahira Beevi (PI), S. Masilamani and R. Balakrishna (upto June 2013)

Duration: July 2010 to June 2013

Budget: 0.80 lakhs

Objective:

- To estimate the rhizosphere microbial population including beneficial flora like asymbiotic nitrogen fixers and phosphorus solubilizers in the rhizosphere of mulberry grown under different set of cultivation practices under alkaline soil conditions.

Methodology

Selections of farmers who are practicing different irrigation practices under high alkaline conditions were made through survey method in Erode and Krishnagiri districts. Further selction of five farmers were made under each category. To study the soil status (pH, EC, OC%, Available P and K). Season wise

rhizosphere soil samples were also collected for analysis for two years. Serial dilution plate count technique was employed using specified media for different organisms. Survey conducted in 50 farmers garden practicing different types of cultural practices and identified 20 farmers for project implementation. Collected soil samples from the identified farmers and analyzed for physical and chemical properties before imposing treatment. Average soil pH ranged from 8.23 to 8.77 and EC <1.00 mmhos/cm^2. Treatments were imposed in identified farmers' garden for the three seasons.

Observations/Results

The pooled data revealed higher bacterial, fungal and actinomycetes population in the rhizosphere of the treatment green manure with drip irrigation in all the three seasons studied in comparison to other treatments. Among the beneficial microflora *Azospirillum* population was predominant in all the treatments compared to *Azotobacter* and PSB. Maximum population of *Azospirillum* ($27x10^2$), *Azotobacter* ($5x10^2$), *Pseudomonas* ($7x10^2$) were observed in the rhizosphere of green manure with drip irrigation treatment. Among the fungal population dominant types were different forms of saprophytic fungi like *Penicillium*, *Aspergillus*, *Rhizoctonia*, *Fusarium* and *Verticillium* were observed. However *Penicillium* and *Aspergillus* were repeatedly and highly prevalent in all the seasons. Increased microbial population in rhizosphere is the clear indication of their role in soil fertility. The most preferred nitrogen fixing bacteria, *Azospirillum* strain was found to be repeatedly occurring in the rhizosphere which could be effectively utilized for developing biofertilizers suitable for alkaline soils under Tamil Nadu condition. Green manuring in mulberry garden at least two to three times in a year can be popularized in the field through OFTs as they play a potential role for nutrient transfer in the rhizosphere of plants by way of decomposing various organic materials and improving the organic carbon content and nutrient uptake.

7.3 MPR (S) 8003: Effect of shoot harvest techniques and biomass yield of mulberry on soil organic carbon status in mulberry fields

S. Masilamani (PI), S. Balasaraswathi, N. Dhahira Beevi

Duration: July 2010 to June 2013

Budget: 2.07 lakhs

Objectives:

- To estimate the organic carbon loss in the soil of mulberry field
- To develop suitable recommendation to improve soil organic carbon in the mulberry fields for sustainable crop production.

Methodology

To estimate the soil organic carbon loss in mulberry field following treatments were used. Collection of Bench mark data on soil properties (pH, OC, EC, P & K) prior imposing the treatment. Collection of data on crop wise leaf, shoot and biomass yield and observation of soil properties (pH, OC, EC, P & K) were made after a period of two years for comparison.

Treatment Details:

T0 - Leaf harvest - 20 M.T of FYM/ha/yr & Chemical fertilizer N:P:K 350:140:140 kg/ha/yr.
T1 - Shoot harvest - 20 M.T of FYM/ha/yr & Chemical fertilizer N:P:K 350:140:140 kg/ha/yr.

Similarly, management of soil organic carbon in mulberry field was studied with following treatments in three replication in randomized block design. Bench mark data on soil properties (pH, OC, EC, P & K) were collected prior to implosion of the treatments. After a period of two years data were collected on soil properties (pH, OC, EC, P & K), and crop wise leaf, shoot and Biomass yield.

Treatment Details:

T0 - Control (Existing practices) 20 M.T of FYM/ha/yr & Chemical fertilizer N:P:K 350:140:140 kg/ha/yr
T1 - FYM + Sericultural compost + Vermicompost = 20 + 5 + 5 MT/ha/yr; Biofertilizer 20 kg/ha/yr in 5 splits; Phosphobacteria 10 kg/ha/yr in 2 splits; Green manure – Dhaincha (*Sesbanica aculeate*) 2 crops/yr in the monsoon & 50% of Recommended Chemical Fertilizer (NPK)

T2 - FYM + Sericultural compost + Vermicompost = 20 + 5 + 5 MT/ha/yr; Biofertilizer 20 kg/ha/yr in 5 splits; Phosphobacteria 10 kg/ha/yr in 2 splits; Green manure – Dhaincha (*Sesbanica aculeate*) 3 crops/yr & 25% of Recommended Chemical Fertilizer (NPK)

T3- FYM + Sericultural compost + Vermicompost = 20 + 5 + 5 MT/ha/yr; Biofertilizer 20 kg/ha/yr in 5 splits; Phosphobacteria 10 kg/ha/yr in 2 splits; Green manure – Dhaincha (*Sesbanica aculeate*) 4 crops/yr & 25% of Recommended Chemical Fertilizer (NPK)

Observations/Results

The biomass production in leaf harvest method was found to be 25% more compared to Shoot Harvest method. Decrease in pH from alkaline level and increase in organic carbon (OC) content was observed in mulberry field where leaf harvest technique was practiced (Tables 7.3; 7.4).

Table 7.3: Biomass production in mulberry field under two different harvest techniques

Sl. No.	Treatment	Leaf yield (kg/ha/Yr)	Shoot yield (kg/ha/Yr)	Total Biomass (kg/ha/Yr)
1	Leaf Harvest (T0)	48640	17623	66263
2	Shoot Harvest (T1)	46640	37316	83956
			Student 't' value (Observed)	26.18
			Tabular value at 0.05 level of probability	2.5

Table 7.4: Soil Parameters in two different treatments

Sl.No	Soil Parameters	Leaf Harvest Field (T0)		Shoot Harvest Field (T1)	
		Bench Mark	After 2 years	Bench Mark	After 2 years
1	pH	8.29	8.0	8.01	8.18
2	OC	0.63	0.92	0.74	0.66
3	EC	0.056	0.047	0.088	0.037
4	P	10.1	12.4	3.2	11.4
5	K	985	1120	1030	1160

The biomass yield found to be less in treatment – 1 (T-1) when compared to rest of the treatments and the difference was found to be significant at 5%. Decrease in pH from alkaline level and increase in organic carbon content (OC) was observed in high organic input treated mulberry plots (Table 7.5 & 7.6). The shoot harvest practices increase biomass production to a tune of 25% more in mulberry fields when compared to leaf harvest which is the main cause for increase in pH and decrease in organic carbon content. In order to sustain soil health, it is very much essential to increase the organic input in mulberry fields. In this study, input included in treatment 2 & 3 to be recommended to the farmers to maintain their soil health and production in sustainable manner.

Table 7.5: Biomass yield in different treatments

Sl. No	Treatment	Leaf yield (kg/ha/Yr)	Shoot yield (kg/ha/Yr)	Total Biomass (kg/ha/Yr)
1	T- 0	45945	36756	82701
2	T- 1	44555	35644	80199
3	T- 2	45780	36624	82404
4	T- 3	46060	36848	82908
			F test (Observed)	4.57
			Tabular value at 0.05 level of probability	4.26

Table 7.6: Soil parameters in different treatments

Sl. No	Soil Parameter	Bench Mark	After 2 years	Remarks
Control (T0)				
1	pH	8.25	8.35	Increase in pH observed
2	OC	0.74	0.73	No improvement in OC
3	EC	0.097	0.37	
4	P	3.2	6.4	
5	K	1030	1120	
Treatment (T-1)				
1	pH	8.22	8.21	pH remain unchanged
2	OC	0.89	0.73	Decrease in OC observed
3	EC	0.083	0.051	
4	P	2.1	4.0	
5	K	1075	1030	
Treatment (T-2)				
1	pH	8.25	7.92	Decrease in pH observed
2	OC	0.63	0.73	Increase in OC observed
3	EC	0.062	0.053	
4	P	2.7	9.7	
5	K	1120	1075	
Treatment (T-3)				
1	pH	8.4	7.83	Decrease in pH observed
2	OC	0.63	0.92	Increase in OC observed
3	EC	0.097	0.055	
4	P	10.1	12.4	
5	K	985.6	1120	

7.4 SEM(S) 8004: Studies on the adoption of mulberry and silkworm pest management technologies IPM) by the sericulturists in Tamil Nadu

S. Balasaraswathi (PI) and R. Balakrishna (upto June 2013)

Duration: July 2010 to June 2013

Budget: 0.32 lakhs

Objectives:

- To find out the level of knowledge and adoption of mulberry and silkworm pest management (IPM) practices by the sericulturists of Tamil Nadu.
- To identify the factors influencing the adoption of IPM by the sericulturists in Tamil Nadu.

Methodology

Collection of data on IPM of mulberry and silkworm pests from 70 sericulturists in Salem and Krishnagiri districts by the interview method with the help of structured questionnaire to get the information on adoption of IPM of tukra mealy bug, papaya mealy bug, leaf webber and thrips. The IPM practices for major pests of mulberry and silkworm pest are given in Table 7.7.

Table 7.7: IPM practices for major pests of mulberry and silkworm pest

Sl. No.	Particulars of practices
I	**Pink mealybug (*Maconellicoccus hirsutus*)**
A	**Cultural/mechanical practices**
	Clipping and destruction of affected portions
B	**Chemical control method**
	Spraying 0.1% DDVP two times at 10 days interval
C	**Bio-control method**
	Release of predatory ladybird beetle (*Crytolaemus montrouzieri*) @ 250 adults/acre
II	**Leaf webber (*Diaphania pulverulentalis*)**
A	**Cultural/mechanical practices**
	Manual collection and destruction of larvae
	Collection and burning of dry leaves and weeds harboring pupae
	Setting up of light traps @ 2 traps per acre to kill adults
B	**Chemical control method**
	Spraying 0.1% DDVP on the infested apical portions
C	**Bio-control method**
	Release of predatory ladybird beetle (*Crytolaemus montrouzieri*) @ 250 adults/acre
III	**Papaya mealybug *(Paracoccus marginatus*)**
A	**Cultural/mechanical practices**
	Clipping and destruction of affected portion
	Crop sanitation
	Praying strong jet of water to dislodge and wash out the pest
B	**Chemical control method**
	Two sprays *viz*., 0.05% Dimethoate followed by 0.1% DDVP in 0.5% soap solution
C	in 10 days interval
	Bio control method
	Release of parasitoids (*Acerophagus papayae*) @100 per acre
IV	**Thrips (*Pseudodendrothrips mori)***
A	**Cultural/mechanical practices**
	Spraying strong jet of water to dislodge and wash out the pest
B	**Chemical control method**
	Two sprays *viz*., 0.05% Dimethoate followed by 0.1% DDVP in 0.5% soap solution in 10 days interval
C	**Bio-control method**
	Release of chrysopa @1000/acre
V	**Uzifly (*Exorista bombycis*)**
A	**Cultural/mechanical practices**
	Provision of wiremesh for windows and doors of the rearing house
	Collection and burning of uzi pupae from the rearing house
	Setting up of uzi traps
B	**Chemical control method**
	Application of uzicide during 3,4 and 5th age of silkworm rearing
C	**Bio-control method**
	Release of pupal parasitoids *Nesolynx thymus* 20,000 no for rearing 100 dlfs from 3rd age of silkworm rearing

Observations/Results

Adoption levels of IPM practices of mulberry pests were full adoption 10.0% (0 to 17.1%), partial adoption 65.7% (54.3 to 85.7%) and non-adoption 24.3% (14.3 to 25.7%), IPM practices of uz ifly recorded full adoption 25.7%, partial adoption 68.6% and non-adoption 5.7% in Krishnagiri district. Adoption levels of IPM practices of mulberry pests in Salem district were full adoption 7.1% (0 to 17.1%), partial adoption 55.7% (31.4 to 77.1%) and non-adoption 37.2% (17.2 to 68.6%), the adoption levels of IPM practices of uzi fly in Salem district were full adoption 17.1%, partial adoption 82.8% and non-adoption 0.0%. Among the mulberry pests the maximum adoption of physical/mechanical control was recorded with leaf webber (25.7%)

and in case of chemical control the adoption level was maximum with thrips (54.3%) where as papaya mealy bug recorded the maximum adoption of 67.1% with respect to biological control methods and minimum in thrips (2.9%). Majority of the respondents (60.7%) were partial adopters. Only 30.7% of the respondents were non-adopters with regard to adoption IPM practices for mulberry pests. Non- availability of IPM inputs on time (20.0%), low adoption by neighbourhood farmers (32.9%), IPM practices difficult to adopt (31.4%), aware about the IPM practices but not confirmed (42.9%), no belief in IPM practices (7.1%), no incidence of pests (4.3%) and not aware of IPM practices (7.1%) were the constraints expressed by the farmers in adoption of IPM practices for the mulberry and silkworm pests. The data on the awareness about the pesticide externalities reveals that 20% of the respondents have awareness on ecological ill effects, 31.4% on health hazards, 30.0% on pesticide residue in mulberry plants and only 7.1% on the reduction of natural enemy complex in the mulberry ecosystem.

There is an urgent need to intensify the efforts to organize extension educational programmes like trainings, demonstrations, field days etc., by the extension agencies to motivate the farmers to accept and adopt the IPM practices in the study area. Distribution of pamphlets on the impact of IPM of mulberry and silkworm pests in the regional languages needs to be intensified through extension programmes. Special emphasis should be given to promote eco-friendly bio control methods against mulberry and silkworm pests. Availability of technical inputs should be made easy at the door steps of farmers. Sericulturists should also be enlightened on the demerits of using insecticides as well as the merits of using eco-friendly methods for the management of mulberry and silkworm pests through TOT programmes. Identification of entrepreneurs and training in the government biocontrol laboratories for mass multiplication and supply of biocontrol agents in villages under government schemes is proposed to be taken up.

7.5 SEM(S) 8006: A study on the adoption of recommended package of practices followed by sericulturists of different farm sizes in Tamil Nadu

S. Rajakumar (PI) and R. Balakrishna (upto June 2013)

Duration: July 2010 to June 2013

Budget: 0.32 lakhs

Objectives:

- To find out the level of adoption of recommended package of practices of Sericulture followed by different farm size groups in traditional and non-traditional regions.
- To find out the factors influencing the adoption levels of recommended Sericulture packages.
- To find out the constraints for the non-adoption or partial adoption of recommended sericulture packages.
- To suggest fine tunings of technologies / measures for improving the level of adoption of recommended sericulture packages of practices.
- To find out the socio-economic profile of farmers of different farm sizes in traditional and non-traditional regions.
- To work out the economics of sericulture on different farm size groups in traditional and non-traditional regions.

Methodology

A total sample of 120 farmers was selected from different villages of Krishnagiri and Erode districts (random sampling). Thus from each district 60 samples were drawn at random and were divided into four farm size groups such as Size group I (1 acre size group) II (1.01-2.0 acre), size group III (2.01-3.0 acre) and size IV (Above 3.01 acre) and covered under the study. A well structured interview as per the performa was used for collection of details of socio-economic, socio-personal knowledge, adoption and constraints encountered by the farmers in the adoption of packages of practices developed by the Research Institute and economics of their practices. The following statistical tools percentage analysis, Simple correlation co-efficient and benefit cost ratio were used for the study based on the nature of data and objectives of the study.

Observations/Results

Adoption level of recommended package of practices and sericulture technologies in Erode and Krishnagiri district are depicted in Tables 7.8; 7.9. The adoption of the recommendation was found high in Erode as majority of them to the extent of 51.3 % to 61.4 % across the farm size holdings possessed full Knowledge and a maximum of 46 % to 61.40 % across the holdings adopted the recommendation fully. In Krishnagiri majority of the farmers had partial Knowledge and majority of them had partially adopted the technology. The adoption indices of sericulture technologies (Both mulberry and silkworm) of the farmers in Erode was found to be higher to an extent of 92% and 84% (pooled) especially as against 82% and 74% (pooled) in Krishnagiri respectively.

The adoption level of mulberry cultivation technologies like mulberry variety (100 & 89%) , Spacing, (100 & 82 %) and FYM application (89 & 75%) in full were found 93.5 & 79% Erode (pooled) and Krishnagiri (pooled) farmers respectively. The farmers of Erode were rational in utilization of the water for irrigation of mulberry gardens and also sensitive on the nutritional requirement of mulberry gardens. The adoption level of drip irrigation (87.6%) & the foliar application were found to be high (77.9%) in Erode. In Krishnagiri though the most of the farmers posed full knowledge on drip irrigation & the growth promoters majority of them were found to be non adopters of the technologies to the extent of 92% and 62 % respectively. The green manure crops as an inter crop as in mulberry for the improvement of soil health and fertility has gained momentum in the study area.

The problems experienced by the farmers (Table 7.10) under F.S.H-I were high cost of cultivation (100%) followed by 93.3 per cent of farmers facing the problem of non availability of labours. Whereas 86.6, 83.3 and 76.6 percent of respondents had problems like, high cost of inputs, occurrence of pests and diseases and non availability of loans, respectively. In case of F.S.H-II all the farmers (100%) were facing the problems of non availability of loans followed by 96.6, 90.0 and 86.6 percent of respondents were facing the problems like lack of improved mulberry and silkworm breeds, high cost of cultivation and non availability of good quality seeds, respectively. The other constraints expressed by the respondents were lack of inadequate equipments, low cocoon price (76.6%), non availability of labourers (73.3%), lack of temperature tolerance breeds (70.0%) and occurrence of pests and diseases (63.3%). Constraints experienced by the farmers with respect of F.S.H-III & IV were lack of water resources for supplementary irrigation (100%), high cost of cultivation (96.6%) and non availability of laborers (90.0%) were the major problems expressed by the respondents followed by high cost of inputs (86.6%) non availability of IPM materials in time (73.3%), non availability of loans (70.0%), lack of disease resistant mulberry variety (66.6%) and lake of disease tolerance silkworm races (63.3%). It is essential to popularize the sericulture based integrated farming system concept to help the farmers to utilize the resources effectively and maximize the productivity and net farm income on a sustainable basis.

Table 7.8: Adoption level of recommended package of practices in Erode and Krishnagiri districts

Farm size	Erode (%)			Krishnagiri (%)		
	Full	Partial	No	Full	Partial	No
I	61.40	32.60	6.00	55.74	25.30	18.96
II	60.30	24.67	15.03	56.60	32.67	10.73
III	51.30	44.80	3.90	53.20	42.40	4.40
IV	58.15	26.86	14.99	46.00	38.86	15.14

Table 7.9: Adoption level of sericulture technologies in Erode and Krishnagiri districts

Technology	Erode (%)			Krishnagiri (%)		
	Full	Partial	No	Full	Partial	No
Mulberry Cultivation						
V1 Mulberry variety	100	0	0	65	25	10
Spacing	100	0	0	82	10	8
FYM application	89	6	5	75	12	13
Drip Irrigation	87.6	10	2.4	56	12	32
Growth Promoter	77.9	15	7.10	62	22	16
Green Manuring	39.5	20	40.5	20	28	52
Bio-fertilizer	21	27.6	51.4	8	20	72
Chemical Fertilizer	68	26	6	46.5	32	21.5
IPM tukra	53	18	29	25	10	65
IPM Leaf webber	75	15	10	29	16	55
Silkworm Rearing						
Separate Rearing House	100	0	0	68	14	18
Shoot rearing	100	0	0	60	21	19
Rearing House Disinfection	100	0	0	72	18	10
Incubation of eggs	100	0	0	64	23	13
Black boxing	100	0	0	28	10	62
Bivoltine Rearing	90	5	5	45	25	30
Use of bed disinfectants	75	15	10	68	26	06
Chawki-wrap up method	78	12	10	35	55	10
Use of rotary mountages	78	13	9	15	53	32
Separate Rearing House	100	0	0	68	14	18

Table 7.10: Reasons for partial and non adoption of sericulture technologies

Farm Size	Mulberry Cultivation & Silkworm Rearing)	Reasons In (%)	
		Erode	Krishnagiri
No. I			
1	High cost of cultivation	100.0	100
2	Non - availability of labour	93.3	80
3	High cost of input	86.6	90
4	Occurrence of pest / Disease	83.3	95
5	Non-availability of loan	76.6	89
No. II			
1	Non-availability of loan	100.0	100
2	Lack of improved Mulberry & Silkworm seed	96.6	85
3	High cost of Cultivation	90.0	95
4	Non-availability of good quality seed	86.6	91
5	Inadequate Equipment	76.6	89
6	Low Cocoon Price	75.0	92
7	Non-availability of labour	73.3	86
8	Lack of Temperature tolerance race	70.0	91
9	Occurrence of Pests & Disease	63.3	88
No. III & IV			
1	Lack of water for irrigation	100.0	90
2	High Cost of Cultivation	96.6	98
3	Non-availability of Labour	90.0	95
4	High cost of Input	86.6	90
5	Non-availability IPM material in time	73.3	80
6	Non-availability of loans	70.0	92
7	Lack of Disease resistant mulberry	66.6	75
8	Lack disease tolerance silkworm	63.3	85

VI. ONGOING RESEARCH PROJECTS/ PROGRAMMES

8. HOST PLANT IMPROVEMENT

8.1 PIB 3370: Development of superior mulberry varieties by exploitation of hybrid vigour based on molecular marker diversity of parental lines (April 2006 to November 2014)

8.1.1 Primary yield trial of selected genotypes under irrigated conditions

M. K. Prithvi Raje Urs (PI), Rajashekar, K. and V. Girish Naik

Objective:
- Primary yield trial of short-listed genotypes for identification of promising mulberry varieties.

Sixteen promising hybrids short-listed from a hybrid population of over 4000, raised after hybridization among 15 parental combinations of elite and promising mulberry genotypes and subsequent two tier evaluation [progeny row trail and rooting evaluation], were planted in a primary yield evaluation experiment with V1 as the check variety.

Data on growth and leaf yield during 4 harvests of I year were recorded. The initial trends at the end of the 4th crop of I year indicated the superiority of 04 hybrids over the check V1 (Table 8.1).

Table 8.1: Performance of four promising hybrids during the first four harvests of first year

Cross	Genetic distance	Leaf yield (kg/plant)			
		Crop 1	Crop 2	Crop 3	Crop 4
G-2 x AR-11	0.271	0.458	1.095	0.810	0.780
G-4 x RFS-135	0.257	0.623	0.914	0.834	0.810
S-36 x RFS-135	0.247	0.750	0.772	0.955	0.790
G-4 x RFS-135	0.257	0.636	0.871	0.785	0.790
V1 - Check (S 30 x Ber. C776)	-	0.497	0.640	0.600	0.560
CD at 5% level	-	NS	0.160	0.184	0.150

8.2 PIB 3457: Development of disease resistant and productive mulberry genotypes with special reference to root rot and root knot diseases suitable to the seri-zones of south India (January 2012 to December 2017)

8.2.1 Selection of parents showing resistance response to root rot / root knot disease and hybridization

S. Gandhi Doss (PI), M. K. Prithvi Raje Urs, D. D. Sharma (upto 28.02.2014) and N. B. Chowdary (upto 31.05.2013)

Objective:
- To identify and select hybrids resistant / tolerant to root rot and root knot diseases through hybridization, selection and their evaluation in progeny row trial (PRT).

Hybridization was effected among eight female and four male germpalsm accessions selected based on their disease response to root rot and root knot pathogens in artificial inoculation studies. While disease reaction against root rot pathogens ranged from 16.13 – 79.12% of rotten roots among the tested genotypes, resistance reaction was recorded in Vietnam-2, *M. multicaulis,* Cuckpilla, Belidevalaya, Mysore local, MR-2 and Himachal local. Root knot nematode infestation ranged from 10.50 to 85 knots/ 25 g of root among the tested genotypes with none showing resistant reaction. 12 accessions showed moderate resistance response to root knot nematode. A total of 14 crosses were made and a hybrid population of over 10000 seedlings was raised (Table 8.2).

Table 8.2: Details of crosses and seed germination

Sl. No.	Cross	Seed viability (%)	Seed germination (%)
1	Himachal local x C-776	95.25	92.45
2	Himachal local x Mysore local	98.50	95.92
3	Himachal local x China white	94.26	89.45
4	Himachal local x V-1	90.15	87.20
5	Himachal local x Vietnam-2	85.50	81.49
6	Himachal x Almora local	95.46	94.15
7	*M. multicaulis* x V-1	91.15	86.87
8	*M. multicaulis* x Mysore local	97.48	92.78
9	*M. multicaulis* x China white	98.55	95.45
10	*M. multicaulis x* Ber. C776	92.33	85.15
11	*M. multicaulis x* Almora local	90.67	86.67
12	Punjab local x V-1	94.33	91.15
13	Punjab local x Almora local	93.67	88.29
14	Belidevalaya x V-1	96.67	90.15

8.3 MIP 0001: Maintenance of mulberry germplasm, mother culture and demonstration plot (Continuous)

M. K. Prithvi Raje Urs (PI), Rajashekar, K. and S. Gandhi Doss

Objective:
- To maintain valuable mulberry germplasm accessions for utilization in mulberry improvement programmes, maintenance of breeders seed plots of improved mulberry supply of seed material to down stream multiplication centres and maintenance of demonstration plots for the benefit of stakeholders visiting the Institute.

Maintained 75 mulberry germplasm accessions for utilization in breeding programmes. Raised breeders seed plot of five improved mulberry varieties and sixteen varieties in the demonstration plot.

9. HOST PLANT PRODUCTION

9.1 MPR 0047: Effect of conjunctive use of nitrification inhibitors for the efficient utilization of nitrogenous fertilizers for the sustainable mulberry production (October 2012 to September 2014)

Vinod Kumar Yadav (PI), Dasappa, R. S. Katiyar and S. Sen

Objectives:
- To enhance the utilization of nitrogenous fertilizers by conjunctive use of nitrification inhibitors for optimum yield in mulberry.
- Reduction of the chemical fertilizer input application and Leaching.

Table 9.1: Effect of nitrification inhibitors on mulberry growth and yield parameters (Mean of five crops)

Treatments	Leaf yield kg/ha	Plant height (cm)	length of longest shoot (cm)	No. of Shoot/ plant	Leaf moisture content (%)
T1	9942	148	125	14.5	72.4
T2	9825	149	125	13.5	72.0
T3	11335	152	127	13.0	71.9
T4	8967	138	117	11.2	72.3
T5	9085	140	121	11.7	72.1
LSD (P<0.05)	148.57	14.06	8.11	NS	NS

T1: 350 N: 140 P: 140 K kg/ha (Recommended dose as control)
T2: 300 N coated with neem oil (0.5% v/w): 140 P: 140 K kg/ha,
T3: 300 N coated with DCD** (0.50% w/w): 140 P: 140 K kg/ha
T4: 250N coated with neem oil (0.5%v/w): 140 P: 140 K kg/ha,
T5: 250 N coated with DCD (0.50% w/w): 140 P: 140 K kg/ha
*FYM: 25 MT /ha/year as per recommendation
** DCD = Dicyadiamide

The data presented in the Table 9.1 revealed that application of urea along with nitrification inhibitors significantly improved the leaf yield and plant height over recommended dose of fertilizer. The results indicated the possibility that nitrification inhibitors could increase nitrogen use efficiency.

Table 9.2: Effect of nitrification inhibitors on nitrogen, phosphorus and potassium content in mulberry shoot

Treatments	Nitrogen Content (%)	Phosphorus Content (%)	Potassium Content (%)
T1	0.98	0.52	1.08
T2	1.46	0.57	1.16
T3	1.60	0.54	1.13
T4	1.34	0.55	1.17
T5	1.44	0.59	1.19
LSD (P<0.05)	0.088	0.093	0.264

The data presented in Table 9.2 showed that the uptake of nitrogen by the plant is significantly higher in all the treated plots over the control. This indicated that the application of nitrification inhibitors along with urea could play a role in retention of nitrogen in treated plot for a longer period.

Tabe 9.3: Effect of nitrification inhibitors on pH, EC, OC, P and K available in soil

Treatments	pH	EC (mmhos/cm)	OC (%)	Available P (kg)	Available K (kg)	Bacterial population/g soil 10^{-8}
T1	7.8	0.30	0.42	88.00	276.25	1.85
T2	7.7	0.33	0.50	119.25	309.75	1.38
T3	7.6	0.24	0.62	129.25	324.25	1.05
T4	7.7	0.34	0.54	124.00	317.25	1.21
T5	7.5	0.30	0.55	125.50	317.75	1.02
LSD (P<0.05)	NS	NS	0.07	11.92	17.07	0.19

The data presented in Table 9.3 indicated that that application of nitrification inhibitors blended with urea significantly improved the organic carbon content in soil as compared with control. However, the bacterial population decreased from 1.85 in the control to 1.02 x 10^{-8} cfu/g of soil. This indicated that nitrification inhibitors slow down the growth of nitrifying bacteria like *nitrosomonas* and *nitrobactors* in soil, which is responsible for transformation of urea to nitrate form of nitrogen (NO^-_3

that is available to the plant). This leads to increase in nitrogen use efficiency in the soil as well as uptake by the plant.

9.2 MPR 0005 : Monitoring of soil fertility status of mulberry gardens in Karnataka, Tamil Nadu and Andhra Pradesh (Continuous)

K. Vedavyasa (upto May 2013) (PI), **Sibayan Sen (PI),** P. Sudhakar and J. Ravi Kumar

Objective:

- To monitor the soil fertility status of mulberry gardens of Karnataka, Tamil Nadu and Andhra Pradesh by estimating available nutrient status of the soil and recommend balanced use of fertilizers & manures as per soil analytical results.

Fertility studies conducted for 2086 samples of soils from mulberry gardens of South India depicted wide variations. Soil analysis results for Tumkur district showed that soil reaction (pH) varied from 7.5 to 8.5 (above normal) in 86.4% soils, electrical conductivity (EC) in 97.8 % of soil was less than 1.0 mmhos/cm, organic carbon (OC) content of soil was less than normal (0.65 to 1.00 %) for 68.6 % of soils, available phosphorus content was high (> 20 kg/ha) in 40.0 % of soils and available potassium was high (>240 kg/ha) in 74.3 % soils. The corresponding values for Hassan district were 59.1, 100.0, 45.4, 95.4 and 100.0 % and those for Mandya district were 84.8, 2.7, 51.8, 56.2 and 42.0 %.

Similar trends were observed from corresponding soil analytical results of Coimbatore (82.6, 100.0, 47.8, 26.1 and 100.0 %) and Tirupur (87.0, 91.3, 87.0, 0.0 and 100 %) districts of Tamil Nadu. Acidic (<6.5) soil pH, normal EC, normal OC, less than normal (<10 kg/ha) available phosphorus and high available potassium were recorded from 100.0, 100.0, 46.7, 73.4 and 100.0 % soils of Waynad district of Kerala while West Godavari district of Andhra Pradesh showed soil pH varying from 6.5 to 7.5 (in 86.7 % soils), normal EC (in 100.0 % soils) and less than normal OC (in 80.0 % soils) (Table 9.4). Appropriate fertilizer/manurial recommendations with suitable management practices for maintaining soil health of mulberry gardens and reclamation measures for problematic soils were provided to the stakeholders as support services to the sericulture industry and for its large scale promotion.

Table 9.4: Soil fertility ranges of mulberry gardens in various States of South India

Place	Parameters tested				
	pH	Electrical conductivity (mmhos/cm)	Organic carbon (%)	Available Phosphorus (kg/ha)	Available Potassium (kg/ha)
Tumkur (KAR)	6.65 - 9.08	0.04 - 3.30	0.07 - 1.38	0.5 - 325.9	79 - 1568
Mandya (KAR)	5.15 - 8.72	0.03 - 2.11	0.06 - 1.10	0.0 - 325.9	45 - 2374
Hassan (KAR)	5.65 - 8.11	0.07 - 0.48	0.44 - 0.96	16.4 - 181.6	179 - 2334
Mysore (KAR)	7.56 - 8.24	0.18 - 2.72	0.56 - 0.89	8.9 - 36.3	358 - 762
Bangalore Rural (KAR)	5.07 - 7.72	0.04 - 0.93	0.11 - 1.20	7.5 - 157.5	134 - 851
Ramanagaram (KAR)	5.19 - 8.63	0.03 - 1.53	0.06 - 1.23	2.0 - 913.2	90 - 1658
Tirupur (TN)	7.44 - 8.60	0.11 - 1.60	0.08 - 0.89	0.6 - 20.7	941 - 1165
Coimbatore (TN)	6.66 - 8.87	0.02 - 0.86	0.07 - 1.36	3.7 - 53.2	896 - 1210
Tirunelveli (TN)	6.58 - 8.85	0.01- 0.97	0.08 - 1.35	0.7 - 80.5	941 - 1210
Dindugul (TN)	7.10 - 8.91	0.02 - 0.74	0.11 - 0.91	0.9 – 19.6	941 -1210
Waynad (KER)	4.50 - 6.10	0.03 - 0.19	0.44 - 1.45	1.0 - 24.5	896 - 1165
West Godavari (AP)	5.84 - 7.39	0.02 - 0.11	0.26 - 0.78	-	-
Total soil samples	**2086**	**Recommendations given to individual farmer**			

10. HOST PLANT PROTECTION

10.1 MPT 0046: Long term effect of mulberry cropping systems on soil biology and productivity (July 2011 to June 14)

CSRTI, Mysore: **V. Nishitha Naik (PI),** Pratheesh Kumar, P. M, D. D. Sharma (upto Jan. 2014), K. Vedavyasa, (upto June 2013), S. Sen and M. Rekha.

RSRSs : M. T. Himatharaj, M. R. Mallikarjuna, M. R. Subrmanyam, P. Sudhakar, M. P. Reddy, T. Mogili, Venkatachalapathy, P. Venkataramana, B. Vijaya Naidu and Ravi Kumar

Objectives:

- Study on the role of soil microflora and macro fauna towards sustainable mulberry production.
- To study the beneficial/ antagonistic microbes associated with soil health in different cropping systems.
- To investigate the factors responsible for the soil microorganisms to turn into epidemic ones.

Microbes are major component of rhizosphere and the composition of this differs greatly from soil to soil and place to place, as a result diverse plant microbial interactions too. Qualitative and quantitative microbial activities are the key factors for productivity and sustainability of soil health for maintenance of production. Some of these interactions involve beneficial exchange of nutrients and are encouraged to enhance the productivity of the crop, whereas interaction with disease causing pathogenic microbes can result in crop damage and yield loss. Soil organic matter plays an important role in multiplication and survival of these microbes. Soil organic matter accelerates the growth of beneficial micro-organisms which act as bio-agents against the pathogenic microbes. This study helps to know the long term effect of various cultivation practices on microbial population dynamics, their interaction with beneficial and pathogenic microbes, nutrient status of mulberry cropping and other cultural practices which farmer practices over the years. For this soil samples were collected from identified mulberry gardens in 3 states *viz.,* Karnataka, Andhra Pradesh and Tamil Nadu. A total of 240 soil samples were collected during rainy, winter and summer seasons. An average of 150.07×10^6 CFU/g soil of microbes was isolated from these soil samples. Fungi, bacteria and actinomycetes were recorded as 58.47×10^6, 68.05×10^6 and 23.55×10^6, respectively. They were grouped as beneficial (62.6×10^6), harmful (34.22×10^6) & saprophytic (53.25×10^6). Further, soil samples were analyzed for physical and chemical properties which revealed that soil colour varied from light red to light black and texture from sandy loamy to sandy clay loam. Among the experimental sites 83 % of mulberry gardens are having pH above critical limit (> 7.5) and 44% of them have OC below critical limit (< 0.5%). Due to higher pH and less organic content, most of the nutrients are not available to the plants. Hence, there is a chance of enhancement of root diseases. Under nutrient deficiency conditions weakly pathogenic species become more serious. Stressed plants may also be susceptible to attack by secondary pathogens or pathogens that infect through wounds.

10.2 PRE 3486: Development of Database for Mulberry Diseases (August 2012 to July 2014)

P. M. Pratheesh Kumar (PI), V. Nishitha Naik, D. D. Sharma and A. M. Babu

Objectives:

- To develop database pertaining to mulberry diseases in India.
- To develop a web based disease diagnosing system.
- To develop distribution map of important mulberry diseases of India.
- To develop a web based forewarning system on possible outbreak of the diseases to alert extension functionaries.

Diseases are one of the limiting factors for successful mulberry cultivation. These diseases impair quality and quantity of leaf produced. The occurrence of these diseases may vary from season to season and place to place based on the climatic factors. Enormous studies were conducted in India on various aspects of mulberry diseases during the last few decades, which included isolation, identification of disease causing pathogens, diagnosis and intensity of diseases in various agroclimatic conditions, etiology,

epidemiology, management and resistance response of mulberry genotypes. However, this information is scattered. To congregate all information in one place is the main object of this study. Further, there is no web based forewarning system for occurrence of disease to take proper management strategies. In order to develop a database, published literature on various aspects of mulberry diseases till date were collected from various sources such as Journals, books and web sites. Two hundred sixty seven literatures, six disease calendars, detailed write up on 20 diseases and 100 FAQs on various aspects of mulberry diseases were loaded in the web page.

10.3 SEM 0052: On-Farm Trial of Nemahari – A plant based formulation for management of root knot disease of mulberry (October 2013 to September 2014)

CSRTI, Mysore: **D. D. Sharma (PI),** Pratheesh Kumar, P. M. and V. Nishitha Naik

RSRSs: M. R. Subrahmanyam, S. Raja Kumar and N. B. Chowdary

Objective:
- To validate the efficacy of Nemahari – a plant based formulation through on farm trials.

Root knot disease caused by the nematode, *Meloidogyne incognita* (Kofoid & White) Chitwood is a serious threat to mulberry cultivation in all sericultural areas of India, which reduces the leaf yield up to 20%. Since it damages the root system, the plant predisposes to various soil borne pathogens. A plant based ecofriendly formulation Nemahari was developed for the management of root knot disease is confirmed effective to reduce root knot severity and to prevent yield loss in laboratory and some farmers gardens of Karnataka. To validate the effectiveness of Nemahari in other states on farm trial has been taken up at Giddalur in Andhra Pradesh, Kanakapura in Karanataka and Salem in Tamil Nadu. Ten farmers each were selected from 3 states and supplied 3 kg of Nemahari. The disease severity was recorded before application of Nemahari revealed disease ranged from moderate to severe. To corroborate the effectiveness of the product Ist dose of Nemahari was imposed during the month of January. Data on reduction in disease severity 90 days after application of Nemahari was recorded. Based on the severity of disease, application dosage is fixed.

11. SILKWORM CROP IMPROVEMENT

11.1 AIT 3445: Development of robust bivoltine hybrids of silkworm, *Bombyx mori* L, tolerant to high temperature environment of the tropics through DNA marker assisted selection (January 2011 to December 2015)

S. Manthira Moorthy (PI), S. K. Ashwath, Kariyappa and N. Chandrakanth (SRF)

Objectives:
- Identification of DNA markers (SSR) linked to thermo tolerance in silkworm.
- Development of thermo tolerant silkworm breeds / hybrids through DNA marker assisted selection.

To select breeding resource material for development of thermo tolerant breed, 37 silkworm breeds were screened with marker identified for thermo tolerance (LFL1123 and LFL329). Out of 37, two breeds (SK4C and APS110) were selected as donor parents based on presence of marker and four breeds *viz.,* CSR27, SK3 (Oval) and CSR6, CSR26 (Dumbbell) were selected as recurrent parents. These selected parents were crossed and four F_1 crosses were prepared (CSR27 x APS110; SK3 x APS110; CSR26 x SK4C; CSR6 x SK4C) and F1s were crossed with respective recurrent parents and raised four Back cross (BC) lines. Presently lines are in BC_3 generation. In each generation (BC_1-BC_3), DNA was isolated from the BC progeny of each line (20-30 individual moths from each line) and DNA was screened with SSR markers. The progeny showing presence of marker (*i.e.,* heterozygous pattern) was selected for next generation rearing (Fig.11.1-11.4). Further in each generation lines were also screened with high temperature conditions to confirm the phenotypic expression (Fig. 11.5). This process was repeated in each generation.

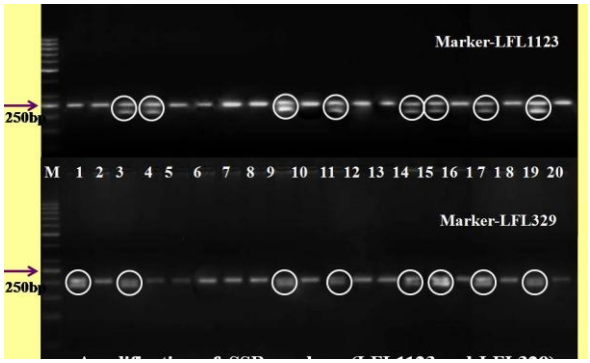


Fig. 11.1

Fig. 11.2

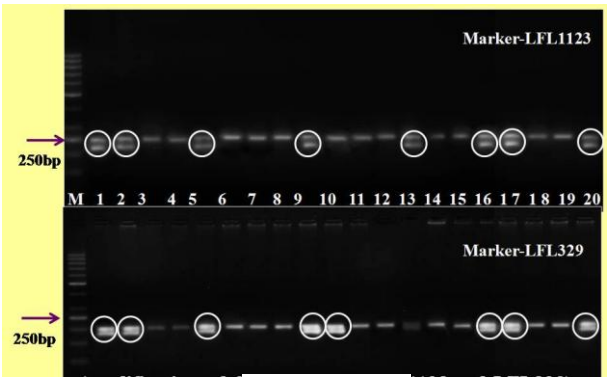


Fig. 11.3

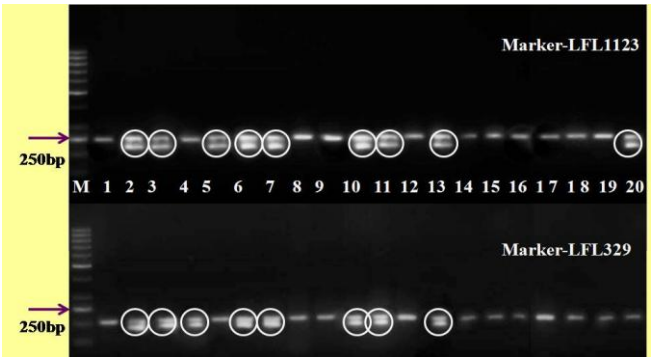


Fig. 11.4

Figs. 11.4 – 11.4: Amplification of SSR markers (LFL1123, LFL0329) in Back cross lines N1 (Fig. 11.1), N2 (Fig. 11.2), N3 (Fig. 11.3) and N4 (Fig. 11.4) in BC_3 generation. M-indicates marker, 1-20 are BC progeny (individual moths). Lanes rounded off show the heterozygous pattern of marker and same progeny was selected for next generation rearing.

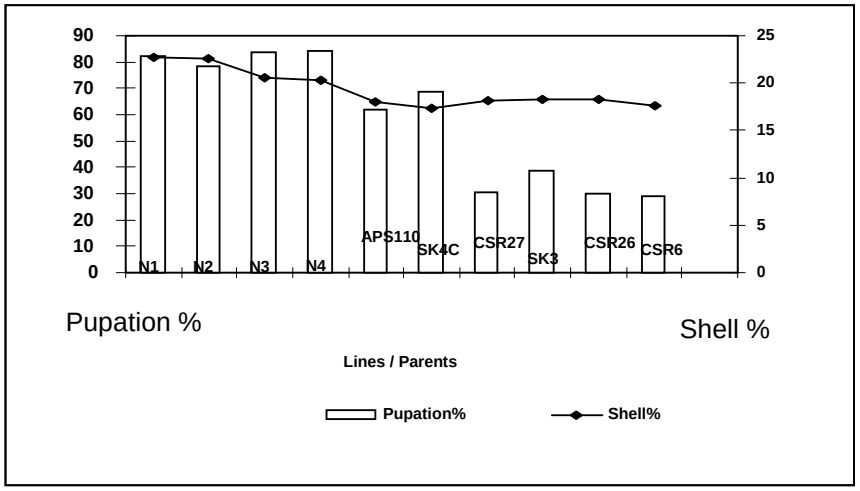


Fig. 11.5: Rearing performance of BC lines and parents under high temperature conditions (36±1°C & 85%RH) in BC3 generation. Where N1-N4 are BC lines, APS110 and SK4C are donor parents and CSR27, CSR6, CSR26 are recurrent parents.

11.2 SIM 0008: Evaluation of three way cross hybrids for commercial exploitation (August 2010 to September 2014)

A. Naseema Begum (PI), N. Mal Reddy and Kariyappa

Objective:

- To identify suitable three-way cross bivoltine silkworm hybrids for commercial exploitation.

The selected three - way cross hybrids *viz.,* FC1 x CSR2, FC1x CSR17, FC3 x CSR2 and FC3 x CSR17 were reared and evaluated in the laboratory. The pupation ranged from 95.8 to 96.3%, cocoon weight ranged from 2.001 to 2.056, shell percentage ranged from 22.2 to 22.9, raw silk ranged from 17.5 to 18.4, filament length ranged from 1041 to 1108 m and neatness above 95.0 points. Two selected three way cross hybrids, FC1 x CSR2 and FC3 x CSR17 were evaluated along with control single and double hybrids at three RSRSs and found that these hybrids are better than single hybrid CSR2 x CSR4 and on par with double hybrid, FC1 x FC2 (Table 11.1 &11.2).

Table 11.1: Rearing performance of selected three- way cross hybrids

Sl. No.	Three way cross hybrids	Egg/dfl (No.)	Pupa-tion %	Cocoon yield/ 10,000 larvae (kg)	Cocoon weight (g)	Shell wt. (g)	Shell %
In the laboratory							
1	FC1xCSR2	580	96.3	19.70	2.038	0.467	22.9
2	FC1xCSR17	570	95.9	19.49	2.001	0.442	22.2
3	FC3xCSR2	600	95.8	19.68	2.056	0.465	22.6
4	FC3xCSR17	610	96.0	19.30	2.016	0.466	23.1
5	FC1 x FC2 ©	612	95.9	19.47	2.029	0.460	22.6
6	CSR2xCSR4©	542	95.5	17.60	1.956	0.448	22.9
	CD at 5%	22	NS	1.2	0.027	0.012	NS
On station trials at RSRSs							
1	FC1xCSR2	579	9531	17.4	1.847	0.393	21.3
2	FC3xCSR17	600	9427	17.0	1.851	0.404	21.8
3	FC1 x FC2 ©	586	9154	16.6	1.812	0.388	21.4
4	CSR2xCSR4©	516	9246	16.6	1.764	0.383	21.7
	CD at 5%	32	1.9	0.09	0.075	NS	NS

Table 11.2: Reeling performance of selected three way cross hybrids

Sl No.	Three-way cross hybrids	Reelability (%)	Filament Length(m)	Denier (d)	Raw Silk (%)	Neat-ness(p)
In the laboratory						
1	FC1xCSR2	86	1058	3.03	18.40	95
2	FC1xCSR17	86	1041	2.98	18.00	95
3	FC3xCSR2	87	1089	2.87	17.80	96
4	FC3xCSR17	86	1103	2.90	17.50	95
5	FC1 x FC2 ©	85	1059	2.86	17.00	95
6	CSR2xCSR4©	86	988	2.89	16.80	94
	CD at 5%	NS	36	NS	NS	NS
On station trials at RSRSs						
1	FC1xCSR2	86	972	2.78	16.6	94
2	FC3xCSR17	85	961	2.72	16.8	94
3	FC1 x FC2 ©	79	906	2.75	15.3	93
4	CSR2xCSR4©	79	899	2.63	16.0	93
	CD at 5%	NS	32	NS	NS	NS

C – Control hybrids

11.3 SIM 0016: Maintenance of Bivoltine breeder's stock of germplasm (Continuous)

E. Rajalakshmi (PI) and R. Gururaj

Objective:
- To systematically maintain newly evolved breeders stock of bivoltine silkworm germplasm, to its original characters, to support the genetic resource requirements of silkworm breeders.

A maintenance rearing of breeders stock of 29 bivoltine germplasm breeds- 20 evolved breeds of SSBS, Coonoor, 11 breeds of CSR&TI, Mysore which were used as resource material in the on- going breeding programs of Coonoor and four breeds to support CSR&TI, Mysore for layings supply under PAT programme (Gen 2, Gen 3, CSR 16 and CSR 17) were carried out.

11.4 SIM 0017: Bivoltine shuttle breeding for development of silkworms with better plastici (Continuous)

11.4.1 Breeding for development of bivoltine breeds with higher productivity under semi tempera conditions of Nilgiris and shuttle breeding to have genetic variation and plasticity.

E. Rajalakshmi (PI) and R. Gururaj

Objectives:
- To evolve new bivoltine breeds for higher productivity, under semi-temperate conditions of Nilgiris.
- To exploit the natural congenial conditions of Nilgiris for bivoltine breeding in the long run.

11 oval races (CNR 4, SLD 1, CSR 17, CSR 46, CSR 47, CSR 50, CSR 202, CSR 204, Gen 3, D 7, D 15) and 4 dumbbell races (SLD 8, CSR 6, D 13, D 17) were identified based on their performance from the germplasm stock races maintained at SSBS, Coonoor as resource material. The following eight breeding plans were effected.

#	Combination	Breeding Plans
1	CSR 17 x CNR 4	(SSBS 1)
2	CSR 50 x SLD 1	(SSBS 2)
3	CSR 202 x CSR 46	(SSBS 3)
4	CSR 204 x CSR 46	(SSBS 4)
5	GEN 3 x D 7	(SSBS 5)
6	CSR 47 x D 15	(SSBS 6)
7	CSR 6 x D 13	(SSBS 7)
8	D 17 x SLD 8	(SSBS 8)

The F 7, F 8, F 9 and F 10 generation rearing of the eight breeding plans were completed. The targeted quantitative traits were achieved successfully.

The experiment is in final stage of combining ability and hybrid evaluation. A total of 30 hybrids were prepared between the eight fixed lines and the first hybrid test was completed. (Table 11.3).

Table 11.3: Performance of fixed productive breeding lines

Breeds	Generation	Fecundity	Pup. rate %	S.C. wt (g)	S.S. wt. (g)	S.R. %
SSBS 1	F 7	572	96.33	1.957	0.436	22.28
	F8	611	96.03	1.943	0.442	22.76
	F 9	620	96.32	1.884	0.438	23.24
SSBS 2	F 7	523	95.73	1.931	0.408	21.11
	F 8	590	95.35	1.916	0.413	21.58
	F 9	578	95.12	1.882	0.411	21.84
SSBS 3	F 7	523	96.23	1.945	0.431	22.17
	F 8	593	95.68	1.851	0.419	22.66
	F 9	550	96.28	1.865	0.439	23.51
SSBS 4	F 7	494	94.17	1.917	0.422	22.03
	F 8	592	93.60	1.846	0.435	23.54
	F 9	562	96.40	1.890	0.453	24.00
SSBS 5	F 7	527	96.53	1.933	0.439	22.74
	F 8	553	95.88	1.840	0.438	23.79
	F 9	552	95.24	1.815	0.440	24.27
SSBS 6	F 7	559	95.27	1.806	0.378	20.93
	F 8	565	95.50	1.705	0.369	21.64
	F 9	513	95.32	1.707	0.380	22.27
SSBS 7	F 7	500	96.90	1.824	0.396	21.74
	F 8	517	95.38	1.843	0.403	21.85
	F 9	521	96.08	1.923	0.447	23.25
SSBS 8	F 7	498	95.72	1.754	0.393	22.41
	F 8	513	95.58	1.629	0.365	22.39
	F 9	507	92.24	1.671	0.391	23.42

11.5 SIM 0015: Bivoltine silkworm race maintenance and multiplication

G. V. Kalpana (PI) and K. B. Chandra Shekar

Objective:
- Race maintenance to supply quality bivoltine eggs to downstream multiplication centers.

All the 13 breeds were reared four times in a year *i.e.,* May ~ June 2013, August ~ September 2013, November ~ December 2013 and February ~ March 2014 by following Silkworm Race maintenance Technology. Mean of four rearing for fecundity, pupation rate, Yield / 10000 larvae by weight, single cocoon weight, single shell weight and cocoon shell percentage is presented in Table 11.4.

Table 11.4: Performance of bivoltine breeds (Mean of 4 rearings)

Breed	Pupation rate (%)	Cocoon yield/10,000 larvae (kg)	S.C. wt. (g)	S.S. wt. (g)	Shell percentage (%)
CSR2	9578 ± 123	18.70 ±1.31	1.913 ± 0.14	0.455 ± 0.03	23.8 ± 0.4
CSR4	9453 ± 224	17.15 ± 1.28	1.807 ± 0.15	0.404 ± 0.03	22.4 ± 0.5
CSR6	9459 ± 122	17.22 ± 0.61	1.812 ± 0.09	0.391 ± 0.01	21.6 ± 0.7
CSR26	9472 ± 100	16.18 ± 1.32	1.690 ± 0.11	0.358 ± 0.03	21.2 ± 0.8
CSR27	9610 ± 105	18.29 ± 1.56	1.901 ± 0.14	0.463 ± 0.02	24.4 ± 0.7
CSR16	9351 ± 160	16.73 ± 1.66	1.792 ± 0.12	0.392 ± 0.002	21.9 ± 0.5
CSR17	9732 ± 25	19.06 ± 1.27	1.925 ± 0.13	0.425 ± 0.03	22.1 ± 0.5
CSR50	9620 ± 149	18.36 ± 1.70	1.891 ± 0.19	0.446 ± 0.04	23.6 ± 0.6
CSR51	9266 ± 66	16.49 ± 1.58	1.753 ± 0.14	0.392 ± 0.03	22.4 ± 0.3
CSR52	9439 ± 79	17.6 ± 1.0	1.808 ± 0.12	0.429 ± 0.02	23.7 ± 0.5
CSR53	9274 ± 171	16.1 ± 1.6	1.728 ± 0.13	0.386 ± 0.02	22.3 ± 0.8
Gen3	9608 ± 139	19.53 ± 1.66	2.020 ± 0.14	0.480 ± 0.04	23.7 ± 0.7
Gen2	9588 ± 90	16.94 ± 1.45	1.777 ± 0.11	0.397 ± 0.03	22.3 ± 0.6

11.6 AIB 3456: Development of productive polyvoltine breeds of the silkworm *Bombyx mori* L. tolerant to high temperature and BmNPV

V. Dayananda (PI), Premalatha and M. Balavenkatasubbaiah

Objectives:

- To develop polyvoltine breeds tolerant to high temperature and BmNPV.
- To identify productive polyvoltine x bivoltine hybrids, which are tolerant to high temperature and BmNPV.

Twelve stress tolerant lines were screened for high temperature at F2, BmNPV at F3 and 18 stress tolerant lines (F4) were reared under normal rearing condition. Screening of progeny under high temperature and BmNPV was repeated at F5 and F6 generations respectively. The rearing of 18 stress tolerant lines at F7 & F8 generation completed under normal rearing conditions. Mid-way evaluation was conducted and the eight short-listed stress tolerant lines are in F9 generation (Table 11.5).

Table 11.5: Performance of stress tolerant lines under normal rearing

#	Lines	Survival (%)	S.C. wt (g)	S.S. wt. (g)	Shell %
1	HB1	98.00	1.213	0.220	18.13
2	HB2	97.92	1.220	0.222	18.18
3	HB3	89.73	1.288	0.265	20.59
4	HB4	98.33	1.247	0.248	19.88
5	HB5	92.26	1.233	0.231	18.77
6	HB6	82.71	1.267	0.232	18.35
7	HB7	91.50	1.321	0.264	20.02
8	HB8	82.61	1.197	0.236	19.72

11.7 SIM 0051: Improvement of breed characteristics of L14 through multilocational Approach (June 2013 to December 2014)

S. K. Ashwath (PI), Mal Reddy; Dayananda, S. M. Moorthy, K. L. Rajanna[1], P. Sudhakara Rao[1], R. Gururaj[2], E. Rajalakshmi[2], G. V. Kalpana[3] and K. B. Chandrashekhar[3]

([1]RSRS, Kodathi, [2]SSBS, Coonoor, [3]P4, BSF, Hassan)

Objectives:

- To isolate and fix improved lines of L14 parental breed endowed with stable expression of non-diapausing, tetra moulting and uniform cocoon shape/colour traits.
- To supply P1 Dfls to generate seed cocoons at CSRTI, Mysore under the project AIB-3488.

Improvement of L14 multivoltine breed was undertaken simultaneously at the Institute, RSRS, Kodathi, SSBS, Coonoor and P4, BSF, Hassan. During the period 5 cycles of selection has been completed. In all the units, the improvement has been achieved with respect of its demerits like variation in larval size, segregation in larval markings, variation in cocoon colour, size and shape. However, it was found that the occurrence of trimoulters and hibernation still persists at Mysore, Coonoor and Hassan, while at Kodathi from II to V cycle, the batches were free from trimoulters and hibernation. The mean performance of all cycles conducted at the respective locations are shown in Table 11.6.

Table 11.6: Rearing performance of L14 breed in different locations (Mean of 5 cycles)

Location	Egg/ dfl	Larval duration (d:h)	Pupa-tion (%)	Cocoon weight (g)	Shell weight (g)	Shell (%)	Trimo-ulters (%)	Hiberna-tion (%)
Mysore	556	22:12	91.79	1.287	0.243	18.86	1.16	3.59
Kodathi	512	25:00	93.46	1.346	0.278	20.65	--	-
Coonoor	588	24:00	93.76	1.520	0.264	17.38	1.12	0.12
Hassan	505	24:00	92.38	1.592	0.274	17.30	1.53	1.19

It has been planned to continue the breeding for two more cycles, the improved lines will be evaluated and the best lines will be maintained for further multiplication.

11.8 SIM 0006: Maintenance of breeds developed through amylase marker assisted selection, multivoltines, NPV tolerance and morphological mutant stocks (January 2010 to January 2015)

K. K. Sharmila (PI), Dayananda, M. Munirathnam Reddy and V. N. Sudha (upto July 2013).

Objectives:

- Maintenance of silkworm races conforming to their original characters.
- Maintenance of the homozygosity of the races developed through amylase marker assisted selection.
- Maintenance of NPV tolerant bivoltine and polyvoltine stocks.
- Maintenance of morphological marker phenotypes in mutant stocks.

Thirty-five polyvoltine breeds were maintained confirming to their original breed character for 5 generations. The rearing and reeling performance of some of the important breeds are presented in Table 11.7.

Table 11.7: Rearing and reeling performance of polyvoltine races/breeds in the laboratory

Race / Breed	Fecundity	Pupation (%)	S.C. wt. (g)	S.S. wt. (g)	Shell %	Filament length (m)	Reel (%)	Raw silk (%)	Neatness (p)
L14	541±91	93.98±2.43	1.318±0.13	0.248±0.03	18.754±1.05	564	81.02	11.47	87
L15	511±78	88.94±9.78	1.301±0.21	0.250±0.05	19.175±0.67	620	85.81	11.92	86
AGL3	519±44	86.90±5.01	1.335±0.18	0.238±0.04	17.721±1.18	526	87.34	11.03	85
AGL5	492±38	89.38±5.37	1.268±0.17	0.234±0.04	18.416±1.21	590	82.79	11.60	86
ND7	549±61	90.76±7.43	1.299±0.14	0.232±0.03	17.863±0.31	512	84.15	11.63	86
ND5	518±45	90.93±3.09	1.295±0.13	0.230±0.04	17.700±1.18	537	81.32	12.01	86
NDV6	507±33	93.21±2.87	1.271±0.24	0.236±0.04	18.622±0.77	495	82.98	10.88	86
NP1	524±34	94.34±2.65	1.288±0.13	0.225±0.03	17.428±0.68	507	82.67	10.9	87

Further, two trials of bivoltine semi-synthetic diet breed maintenance rearings completed. Breeds maintained are CSR2(A), CSR4(A), CSR18(A), CSR19(A), CSR5(A), NB4D2(A), KA(A), CSR20(A), CSR23(A), BMN(A), 3HT(A), B60(A), CSR2SL(A), CSR8SL(A), Kinshu (A), Showa(A), CSR6(A), CSR26(A) CSR27(A), CSR50(A), CSR51(A). Two trials average harvest data revealed feed response ranged between 90.86 and 96.68, pupation rate between 85.92 & 91.75, cocoon wt. between 1.378 & 1.661g, shell wt. between 0.278 & 0.374g and shell % between 18.76 & 22.46. All the trait values are in conformity with the bench mark values.

A total of six trials of multivoltine semi-synthetic diet breed maintenance rearings completed. Breeds maintained are PM (A), PMSL (A), C. niche (A), BL67(A), BL67SL(A), 96C(A), ND7(A)M, ND7(A)P, SPM1(A), SPM2(A), SPM3(A), SPM4(A) & Nistari(A). Six trials average data showed feed response between 90.26 and 95.54, pupation rate between 85.27 & 89.46, cocoon wt. between 0.795 & 1.174g, shell wt. between 0.097 & 0.202g and shell % between 12.19 & 17.18. All the trait values are in confirmity with the benchmark values.

Twenty breeds developed through amylase marker assisted selection, 6 recurrent parents and 14 NPV tolerant breeds & 70 mutant stocks were reared and maintained confirming to their breed characteristics under 2 crops during Aug-Sept and Nov-Dec.2013. Homozygosity for the amylase genes was confirmed by amylase assay in the breeds developed using amylase marker. Egg, larval and moth characteristics were observed and maintained in the mutant stocks. The rearing performance of oval and dumb-bell breeds developed through amylase marker is shown in the Table 11.8 and Table 11.9 respectively.

Table 11.8: Performance of Oval breeds developed through amylase marker assisted selection

Sl. No	Breed	Fecun-dity	ERR /10000 larvae		S.C. wt. (g)	S.S. wt. (g)	SR%
			By No.	By wt. (kg)			
1	GEN1	540±18	9210±47	14.47±1.24	1.633±0.98	0.355±0.23	21.72±0.1
2	GEN3	554±9.5	9142±58	14.92±0.61	1.729±0.45	0.382±0.2	22.1±0.38
3	2C	530±15	9100±284	14.02±0.15	1.587±0.38	0.355±0.02	22.4±0.15
4	2S	490±14	8580±360	13.21±0.93	1.532±0.3	0.323±0.4	21.11±0.86
5	2M	538±8	8520±240	12.86±0.76	1.530±0.18	0.320±0.4	20.91±0.32
6	3C	512±30	8620±207	12.93±0.20	1.518±0.1	0.327±0.4	21.51±0.1
7	3P	524±20	8960±70	13.79±0.675	1.649±0.3	0.354±0.6	22.4±0.3
8	3D	506±22	8580±197	13.04±0.57	1.536±0.3	0.326±0.3	21.22±0.1
9	3N	533±16	8780±876	13.34±1.53	1.514±0.2	0.339±0.3	22.39±0.3

Table 11.9: Performance of Dumb-bell breeds developed through amylase marker selection

Sl. No	Breed	Fecun-dity	ERR /10000 larvae		S.C. wt. (g)	S.S. wt. (g)	SR%
			By No.	By wt.(kg)			
1	GEN2	529±15	9165±160	14.43±0.77	1.621±0.06	0.345±0.01	21.23±0.27
2	GEN4	499±15	8680±169	13.03±0.08	1.511±0.01	0.307±0.6	20.36±0.9
3	4C	468±22	9440±439	15.19±0.47	1.635±0.4	0.348±0.2	21.32±0.8
4	4D	503±18	9110±280	12.63±6.31	1.567±0.6	0.331±0.8	21.10±0.6
5	4P	557±16	8946±679	13.56±0.74	1.564±0.3	0.321±0.7	20.54±0.7
6	4S	501±12	8808±270	13.5+9.92	1.564±0.0	0.352±0.2	21.69±0.6
7	4M3	489±26	8760±365	14.00±1.68	1.672±0.2	0.376±0.4	22.45±0.6
8	4M5	553±32	8955±315	14.61±0.21	1.638±0.09	0.359±0.3	21.93±0.3
9	5P	488±19	8320±220	12.00±0.8	1.504±0.2	0.312±0.4	20.7±0.7
10	**6C**	521±20	8500±450	13.28±0.64	1.60±0.8	0.351±0.3	20.82±0.5
11	**6P**	500±28	8540±230	13.26±0.25	1.604±0.8	0.334±0.5	21.93±1.5

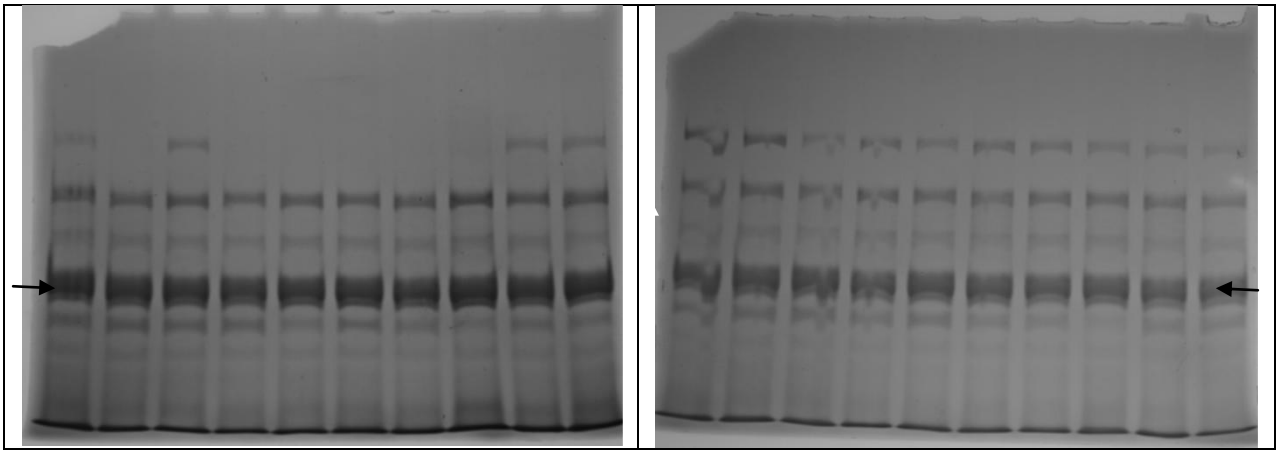
11.9 AIB 3476: Development of productive NPV tolerant bivoltine breeds/hybrids using BmNOX marker assisted selection (April 2012 to December 2014)

S. K. Ashwath (PI) and Virendra Kumar

Objectives:

- To develop productive NPV tolerant bivoltine breeds using BmNOX as a marker.
- To identify NPV tolerant single / double hybrids through laboratory evaluation and in-house testing.

BmNOX (NADPH Oxidoreductase) protein marker assisted selection was continued by using the NPV tolerant silkworm breeds, namely, Nistari, 5N endowed with high BmNOX expression were selected as donor parents (DPs) and productive bivoltine breeds, namely, CSR2, CSR4, CSR6, CSR26 and CSR27, which are susceptible to NPV were selected as recurrent parents (RPs). Digestive juice samples were collected on the 3rd day of 5th instar from the BC progeny individually and screened by SDS-PAGE. The BC individuals with high BmNOX expression were selected and backcrossed to their respective RPs. During the period screening of BC6 progeny was completed after which the progeny were selfed to raise the BC6S1, S2 and S3 generatons. Homozygosity of high BmNOX expression was confirmed in the selfed progeny through protein profilng. Using the selected BC6S3 lines, layings of nine each of single hybrids, oval FCs and dumb-bell FCs were raised for laboratory evaluation.



1	2	3	4	5	8	9	10	11	12	13	14	15	16	17	20	21	22	23	24
----- 2 x Nis BC6S2 fem ---					------ 2 x Nis BC6S2 m ----					----- 27 x Nis BC6S2 fem ---					------ 27 x Nis BC6S2 m ---				

Fig. 11.6: SDS-PAGE profile of BC6S3 selfed progeny. Arrows indicate homozygous pattern of 26.5 kDa BmNOX protein

12. SILKWORM CROP PRODUCTION

12.1 SPR 0019: Large scale in-house evaluation and validation of new silkworm breeds/hybrids of silkworm *Bombyx mori* L., developed at CSRTI, Mysore (Continuous)

P. C. Santha (PI)

Objective:
- To evaluate new silkworm breeds/hybrids under large scale in house rearing simulating to farmers condition with the existing breeds/hybrids.

REARING PERFORMANCE OF L14 BREED

Six trials of silkworm rearing crops of L14 breed were conducted. Totally 4,08,469 Nos. of P1 seed cocoons (531.0 kg.) of L14 breed were generated. Recorded an av. ERR by No. 8429 and av. ERR by Wt. 10.958 kg. for L14 breed. Recorded an av. cocoon wt. of 1.629g, av. shell weight of 0.300g. and av. SR% of 18.42% for L14 race. The rearing performance is presented in the Table 12.1.

Table 12.1: Rearing performance of L14 pure breed

Crop No	No. of Dfls	Fecun-dity	Hatching %	Brushing Date	No. of larvae brushed	Larval Duration (Days)	Coc/ kg
1	200	447	90.40	23.5.13	80,800	23.0	656
2	300	407	90.30	10.7.13	1,10,200	24.0	904
3	200	499	95.60	28.8.13	95,400	23.0	652
4	250	455	91.20	7.10.13	1,03,700	24.0	742
5	150	367	88.20	29.11.13	48,500	24.0	820
6	100	506	91.10	11.1.14	46,000	23.0	722
Tot /Av	**1200**	**447**	**91.13**	**-**	**4,84,600**	**24.0**	**749**

Crop No	Actual yield		ERR/10,000 larvae		SC. wt. (g)	S.S. wt. (g)	SR%	Yield/ 100 Dfls (kg.)
			By No.	By Wt.				
1	67,472	95.00	8351	11.757	1.677	0.314	18.72	47.50
2	90,024	91.00	8169	8.258	1.603	0.291	18.15	30.33
3	88,020	135.0	9226	14.150	1.681	0.311	18.50	67.50
4	83,161	107.0	8019	10.318	1.609	0.290	18.02	42.80
5	39,360	48.00	8116	9.900	1.601	0.292	18.24	32.00
6	40,432	55.00	8790	11.957	1.602	0.301	18.80	55.00
Total /Av	**4,08,469**	**531.0**	**8429**	**10.958**	**1.629**	**0.300**	**18.42**	**45.86**

During the year, a total of 3,50,348 P1 seed cocoons (492.0 kg.) of L14 breed were supplied to SSPC, NSSO, Thirupattur and Ramanagaram.

POST-COCOON EVALUATION UNIT

12.2 SIM 0037: Evaluation of post cocoon parameters of cocoon generated from CSRTI, Mysore and its nested units (Continuous)

Y. C. Radhalakshmi (PI), Kariyappa (CI) and K. P. Shivakumar (CI)

Objectives:
- To Evaluate the cocoon characteristics and post cocoon parameters of pure Bivoltine, Pure multivoltine, multi-bivoltine and Bivoltine hybrid cocoons received from all the sections and RSRS of this institute.
- To compare and evaluate the reeling performance of various breeds/hybrids received at different seasons from various sections in CSRTI and nested units.

A total 328 lots of cocoons were test reeled for post cocoon parameters and analysed the data. The data of reeling performance of each lot has been communicated to the concerned. The number of cocoon lots test reeled during the period was given in table.12.2.

Table 12.2: Number of cocoon lots from different stations

Source	No. of lots tested
BBL	101
MBL	104
Genetics	16
TVDC	3
SSBS Coonoor	12
Molecular Biology	18
P4 BSF Hassan	8
RSRS Kodathi	20
RSRS Ananthapur	6
RSRS Chamarajanagar	13
RSRS Salem	27
Total	**328**

A total of 768 Kg. of cocoons received from different sources for test reeling and mass reeling were stifled, conditioned, cooked and reeled producing 28 kg. of raw silk.

12.3 SIM 0055: Field Trial of Reeling package to reel L14xCSR2 cocoons (January 2014 to March 2015)

Kariyappa (PI), Y. C. Radhalakshmi and K. P. Shivakumar

Objectives:
- To validate the reeling package for reeling of L14 x CSR2 cocoons based on field trials.
- To demonstrate the reeling package to commercial reelers.

As per the plan of work, cocoon markets and reeling units of Ramanagaram were surveyed to identify the commercial reeling units especially multiend units for demonstration and fine tuning of the reeling package developed by the Institute for L14xCSR2 hybrid.

13. SILKWORM CROP PROTECTION

13.1 ARP 3477: Therapeutic control of Microsporidiosis in the silkworm through characterization of Methionine Amino Peptidase enzyme genes (MetAP2) in *Nosema bombycis* (April 2012 to March 2015)

A. R. Narasimha Nayaka (PI) and K. M. Ponnuvel (SBRL, Bangalore)

Objectives:
- Identification of microsporidian genes controlling MetAP2 enzyme using PCR techniques through specific primers from *Nosema bombycis.*
- The cloning and characterization of MetAP2 of microsporidia.
- Development of a process controlling microsporidiosis using certain chemical compounds in the silkworm.

The *Nosema bombycis* spores were multiplied by inoculating the susceptible silkworm breed, which were collected and purified using standard protocol. The purified spores were disrupted using acid-washed 500-µm glass beads. Proteinase K was added to the disrupted spores and the solution was incubated for 15 min at 65°C. DNA was then prepared by phenol/chloroform extraction followed by ethanol precipitation. Purified microsporidian DNA was dissolved in TE buffer used for PCR reaction. The amplified product were cloned and sequenced. Using the BLST tool of NCBI database, the sequence was compared and related sequences were retrieved. Phylogenetic analysis MetAP2 gene of *N. bombycis* was carried out through Clustal W programme, which revealed that the gene sequence is smimlar to that of *Nosema cerenae* of honey bee (Fig. 13.1).

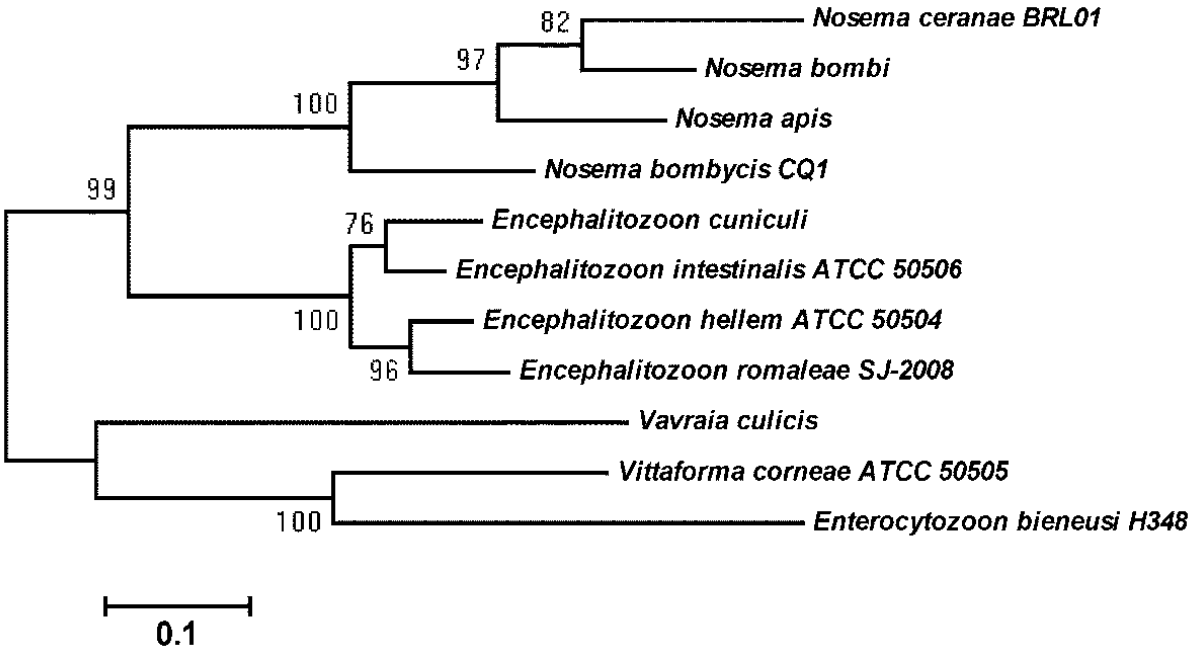


Fig.13.1: Phylogenetic relationships of methionine aminopeptidase 2 (MetAP2) among *Nosema* species and other genotypes of microsporidia

13.2 SPT 0039 : Identification of factors responsible for silkworm crop loss due to diseases at field level and its impact on cocoon productivity (July 2012 to December 2014)

M. Balavenkatasubbaiah (PI) and A. R. Narasimha Nayaka, CSR&TI, Mysore, M. Maheshwari and N. Shivashankar, RSRS-Kodathi, V. B. Mathur, REC-Sub- unit-Maddur, S.Rajkumar, RSRS-Salem, T. Thirunavukarasu, REC-Gobi, P. Samuthiravelu, REC-Udumalpet, B. Kasi Reddy, REC-Madaksira, T. Mogili, REC-V. Kota, B. Narasimha Murthy, REC- Vikarabad and M. Venkateswara Rao, REC-Eluru

Objectives:

- Fortnightly silkworm disease survey in 3 areas of the three states *viz.,* Karnataka, Andhra Pradesh and Tamil Nadu.
- To estimate the extent of crop loss due to the silkworm diseases in the field.

Fortnightly surveys on the silkworm diseases incidence were conducted from April, 2013 to March 2014 in the selected areas of the three states (Table 13.1). In Karnataka, the survey results in 3 districts (Bangalore Rural, Kolar and Mandya) indicated 0.62 to 1.9% Grasserie, 1.42 to 2.85% flacherie and 0 to 1.23% muscardine disease.

The survey results in the 3 districts of Tamil Nadu (Salem, Erode and Tiruppur) indicated 0.05 to 1.47% Grasserie, 0.51 to 2.41% flacherie and no incidence of muscardine during this period. In Andhra Pradesh the survey results in the 4 districts (Ananthapur, Chittoor, Ranga Reddy and West Godavari) indicated 0.69 to 7.46% Grasserie, 0.44 to 1.94% flacherie and 0.00 to 0.44% muscardine disease was observed. There was no pebrine incidence in the surveyed areas during this period.

Table 13.1: Silkworm disease survey 2013-14

Month	Grasserie	Flacherie	Muscardine	Pebrine	Yield/ 100 dfls
			KARNATAKA		
Apr. 2013	1.90	1.42	0.05	0.00	72.56
May 2013	1.46	2.61	0.00	0.00	68.73
Jun. 2013	0.78	1.95	0.25	0.00	72.18
Jul. 2013	1.15	2.05	0.02	0.00	70.63
Aug. 2013	1.01	2.17	0.06	0.00	69.45
Sep. 2013	1.21	2.21	0.03	0.00	73.15
Oct. 2013	1.23	2.85	0.00	0.00	70.51
Nov. 2013	0.73	1.46	0.99	0.00	73.95
Dec. 2013	0.70	1.51	1.23	0.00	71.24
Jan. 2014	0.96	2.21	0.39	0.00	71.57
Feb. 2014	0.62	2.09	0.07	0.00	75.44
Mar. 2014	0.73	2.48	0.22	0.00	69.11
Average	**1.04**	**2.08**	**0.28**	**0.00**	**71.54**
			TAMIL NADU		
Apr. 2013	0.05	2.41	0.00	0.00	58.62
May 2013	1.47	0.98	0.00	0.00	62.01
Jun. 2013	0.22	0.83	0.00	0.00	68.29
Jul. 2013	0.43	1.27	0.00	0.00	64.38
Aug. 2013	0.59	0.51	0.00	0.00	69.79
Sep. 2013	0.17	0.90	0.00	0.00	70.67
Oct. 2013	0.17	0.71	0.00	0.00	71.64
Nov. 2013	0.43	1.05	0.00	0.00	68.89
Dec. 2013	0.20	0.78	0.00	0.00	72.64
Jan. 2014	0.52	0.89	0.00	0.00	74.14
Feb. 2014	0.33	0.73	0.00	0.00	73.08
Mar. 2014	0.60	0.95	0.00	0.00	62.29
Average	**0.43**	**1.00**	**0.00**	**0.00**	**68.04**
			ANDHRA PRADESH		
Apr. 2013	7.46	1.26	0.00	0.00	57.73
May 2013	2.79	1.49	0.00	0.00	58.66
Jun. 2013	1.78	0.56	0.00	0.00	61.53
Jul. 2013	1.35	1.94	0.44	0.00	63.20
Aug. 2013	1.47	1.22	0.00	0.00	63.46
Sep. 2013	1.46	1.16	0.00	0.00	67.63
Oct. 2013	1.24	1.21	0.05	0.00	64.73
Nov. 2013	1.60	0.93	0.00	0.00	63.97
Dec. 2013	0.69	0.67	0.24	0.00	65.67
Jan. 2014	0.74	0.50	0.36	0.00	67.70
Feb. 2014	0.73	0.44	0.24	0.00	68.12
Mar. 2014	1.15	0.61	0.05	0.00	68.58
Average	**1.87**	**1.00**	**0.11**	**0.00**	**64.25**

13.3 SPT 0014: Maintenance of mother culture for production of recommended bio-control agents and mass release of recommended bio-control agents of sericultural pests in CSR&TI campus (Continuous)

Vinod Kumar (PI), J. B. Narendra Kumar, Mary Josepha (Sherry) A. V. (upto Aug 2013)

Objectives:
- To maintain nucleus culture of uzi fly parasitoids and their host insect.
- To maintain nucleus culture of parasitoid and predators of mulberry pests and their insects.
- To release bio-control agents in CRSTI campus for control of mulberry pest and uz ifly.
- To mass produce bio-control agents supply to stake holders.

Nucleus cultures of five parasitoids namely *Nesolynx thymus*, *Exoristobia philippinensis*, *Tetrastichus* sp., *Trichopria* sp. and *Dirhinus* sp., two predators of mealy bug *Cryptolemous montrouzieri* & *Scymnus coccivora* and one egg parasitoid of lepidopteran pest *i.e*., *Trichogramma chilonis* besides host culture of Housefly, pink mealy bug, & *Corcyra cephalonica* were maintained throughout the year. During the period under report, a total of 3,542 pouches of *Nesolynx thymus*, 1,19,750 *Scymnus* beetles (479 boxes) and 337 Tricho-cards were produced. 1038 pouches (103.8 lakhs adults) of *N. thymus,* 21,000 predatory beetles (84 boxes) and 266 Tricho-cards were released in CSRTI campus, which resulted in keeping pest incidence below 5%. In addition, a total of 1,584 pouches amounting to Rs.47,520/- were released in the adopted village of Chikkaharohalli (Srirangapatna taluk) towards ToT programme. A total of 920 pouches of *Nesolynx thymus*, 74,250 *Scymnus* beetles (297 boxes) were sold generating an income of Rs. 63,240.

13.4 SEM 0050: Demonstration of uzi fly management strategies in an adopted village of Srirangapatna taluk (June 2013 to May 2014)

Vinod Kumar (PI) and J. B. Narendra Kumar

Objective:
- To bring down uzi fly infestation belo 2% in the adopted village.

An IPM package (release of ecto-pupal parasitoid, *Nesolynx thymus* @ 2 pouches/100 DFLs*,* placement of uzi trap & packing/burying of silkworm litter in order to kill the uzi pupae available in it) was demonstrated by covering all the sericulturists (about 120) in an adopted village *i.e*., Chikkaharohalli village (Srirangapatna Taluk). A total of 1584 pouches of *N. thymus* were released by covering 78,830 DFLs in 631 crops. Further, the placement of uzi traps inside & outside the rearing houses was able to trap 23,454 uzi flies. The implementation of IPM package reduced the uzi fly incidence from 10.7% (pre demo. incidence) to 0.72%.

13.5 MPT 0053: Forewarning and forecasting of mulberry pests (Continuous)

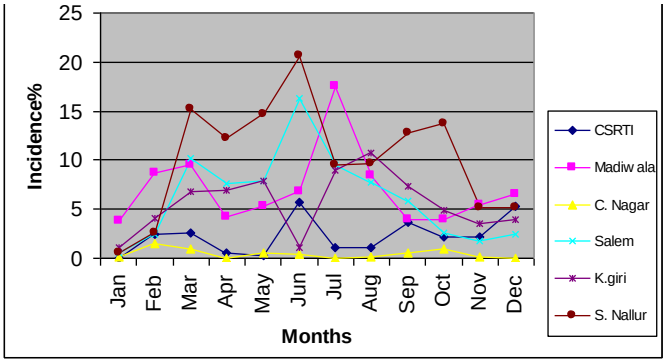
Mary Josepha (Sherry) A. V. (PI), J. B. Narendra Kumar, B. Mallikarjuna, Noble Morrison, K. Masilamani, S. Balasaraswathi, A.G.K. Daniel, M.V. Rao and Santhanu Babu

Objective:
- To monitor the incidence of major mulberry pest in Karnataka, Tamil Nadu and Andhra Prdesh and issue forewarning to stake holders.

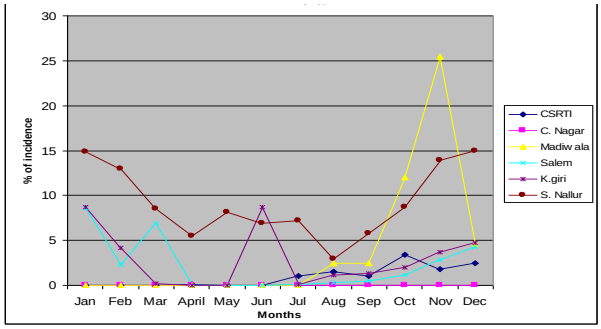
Fortnightly survey on prevalence of pests in mulberry gardens & silkworm rearings at CSR&TI campus were conducted and collected data from 7 nested units *viz.,* RSRS Chamarajanagar, REC Madiwala, RSRS Ananthapur, REC Eluru, RSRS Salem, REC Krishnagiri and REC Samayanallur. Average incidence of major pests like pink mealy bug, thrips and leaf roller at various centres are as follows:

Average tukra incidence was highest in REC Samayanallur (9.95%) followed by REC Eluru (7.9%). In all other centres it was below 5%. Thrips incidence was highest in REC Eluru (13.28%) followed by REC Samayanallur (10.14%), REC Madiwala (7.02 %), RSRS Salem (6.25%) and REC Krishnagiri (5.61%). At CSR&TI, Mysore and RSRS Chamarajanagar was below 5%. Leaf roller incidence was highest in REC Samayanallur (9.92%). In all other 7 centres, it was below 5%. Incidence of other pests like whitefly, papaya mealy bug, jassids and grass hopper as well as incidence of uzi was below 5% in all the centres (Fig. 13.2).

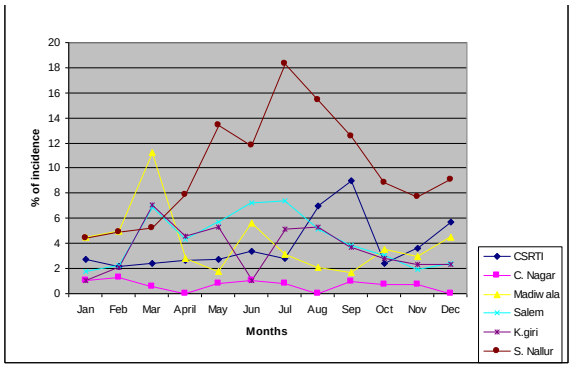
A total of 31 weekly forewarnings were issued for four districts of Andhra Pradesh *viz.,* West Godavari, Srikakulam, Medak and Nalgonda through Silk Portal of CSB, which included 6 forewarnings on thrips, leaf roller, uzi fly, papaya mealybug and Giant African snail through CSR&TI website and one each in Indian silk (on May-June beetle) and local news paper (Leaf roller).



Thrips



Leaf roller



Pink mealy bug

Fig.13.2: Incidence major pests in different agro-climatic zones of south India

14. SERICULTURE EXTENSION

14.1 SEM 0042: Sericulture women and technology transfer – a Group Approach (April 2013 to October 2014)

G. S. Geetha (PI), P. Sudhakar Rao and K. L. Rajanna

Objectives:

- Skill development among sericulture women on improved silkworm rearing and mulberry cultivation technologies.
- Promote sericulture based self employment among rural sericulture women for additional income.
- Create awareness about the available resources/inputs through different government departments/institutions for effective utilization and increased output.
- To improve the yields of cocoons and income of the farmers in sericulture.

Identified Ittasandhra village under Hoskote taluk, Bangalore Rural District for the study. A total of 19 sericulture practicing women were selected for the formation of women group. Formed women group, conducted benchmark survey and initiated technology demonstrations. During a reporting period conducted one group discussion on new technologies for silkworm rearing and two technology demonstration on control and management of muscardine disease and usage of bed disinfectants for quality cocoon production. A total of twenty women sericulture farmers attended the demonstration.

14.2 AIB 3488: Pre-authorization field trials of L14 x CSR2 (Apr. 2012 to Mar. 2014)

Executive Authority: B. B. Bindroo , V. Sivaprasad[1], Arindam Basu[2]

Project Coordinator: S. Nirmal Kumar

Investigators: Dayananda, V. Lakshmanan, P. G. Joge, T. Thippeswamy, J. P. Renukeswarappa, S. Purushotham, D. S. Somaprakash, P. C. Santha, S. B. Kulkarni, G. S. Vindhya, S. B. Nagaraju, M. Balavenkatasubbaiah, K. Chandrasekharan, Y. C. Radhalakshmi, K. P. Shivakumar, S. Kariappa. C. Lakshmanan, K. L. Rajanna[3], Chikkanna[4], Ch. Satyanarayanaraju[5], B. Mallikarjuna[6], Subhash V. Naik[2], B. M. Mahadevaiah[2]

[1]National Silkworm Seed Organisation, Bengaluru, [2]Central Silk Technological Research Institute, Bengaluru, [3]Regional Sericultural Research Station (RSRS), Kodathi, [4]RSRS, Salem, [5]RSRS, Anantapur, [6]RSRS, Chamarajanagara

Objective:

- Large scale pre-authorisation evaluation of new silkworm hybrid L14 x CSR2 with respect to cocoon yield and quality in comparision with PM x CSR2.

During the year six trials of L14 pure were conducted with total quantity of 1250 dfls and recorded an average ERR/10,000 larvae by no 8506 and by weight 10.98 Kg with single cocoon weight of 1.36 (g) and shell percentage of 18.32. Against the target of 4.5 lakhs a total quantitity of 4,60,352 P1 seed cocoons to NSSO, SSPC Ramanagaram and Madanapalli grainage for production of F1 hybrid (L14 x CSR2) for pre-race athorization trails of L14 x CSR2 programme.

A total of 1.19 lakh L14 seed cocoons generated at CSR&TI Mysore and CSR2 seed cocoons as male parent received from NSSO were processed in 4 lots to produce 26450 of L14 x CSR2 dfls. The dfls were supplied to the field under preauthorization field trials. The month wise dfls production are presented in the Table 14.1.

It is inferred from the table that the grainage performance of L14 x CSR2 is consistant and satisfactory with reference to egg yield per kg. of cocoons. The hibernation during the period was less. Further the production in large scale is taken up by NSSO units w.e.f. June 2013.

Table 14.1: Details of L14 x CSR2 dfls production for the year 2013-14

Month	Cocoons by no.	Pupation %	No. of dfls	No. of eggs/g	Hibernation	Egg yield g/kg.
April	22800	84.55	4650	1823	2.41	62.61
April	27893	91.88	5350	1821	1.3	60.20
May	42800	79.91	9700	1760	1.59	63.24
June	25900	90.81	6750	1784	3.05	63.86
Total/Av	**119393**	**86.78**	**26450**	**1797**	**2.08**	**62.40**

During a period a total of 159475 dfls of L14x CSR2 with 802 farmers of RSRS/RECs of Karnataka, Andhra Pradesh, Tamil Nadu and Maharastra were distributed and recorded an average cocoon yield of 51.3 kg/100 dfls. A total of 32,603 dfls of PMxCSR2 distributed with 100 farmers and recorded an average cocoon yield 56.92/100 dfls.

Table 14.2: Rearing peformance of L14 x CSR2 at farmers field

#	Name of the centre	No. of farmers	Dfls distributed	Yield /100 dfls	Rate (Rs.)
1	Karnataka	378	94275	54.16	309.27
2	Andhra Pradesh	127	32200	46.77	313.59
3	Tamil Nadu	186	26100	50.44	312.79
4	Maharashtra & MP	9	1800	44.37	165.50
5	Tripura	98	4000	34.79	250.00
6	Orissa	04	1100	42.66	317.50
	Total/ Average	**802**	**159475**	**51.30**	**313.68**

15. SERICULTURE ENGINEERING

The impact of mechanization on sericulture on various aspects worked out. Through mechanization the productivity of the workers can be enhanced as detailed in Table 15.1. The mechanization will help in curtailing the expenditure on various works as detailed in Table 15.2.

Table 15.1: Improvement in workers efficiency through appropriate mechanisation

#	Activity/work	Worker's output		Gain in workers output through mechanisation (B/A)
		Manual (A)	With machine (B)	
1.	Land preparation	2,000 m^2/day	20,000 m^2/day	10 times
2.	Mulberry cutting preparation	300 cuttings/h	1,200 cuttings/h	4 times
3.	Shoot harvesting	200 kg/day	1200 kg/day	6 times
4.	Intercultural operations	1,000sqm/day	20,000sqm/day	20 times
5.	Leaf chopping	20 kg/h	200 kg/h	10 times
6.	Matured silkworm picking	30 dfls/day	300 dfls/	10 times
7.	Cocoon harvesting	10 kg/h	50 kg/h	5 times
8.	Cocoon deflossing	5 kg/h	50 kg/h	10 times
9.	Tray washing	25 trays/h	100 trays/h	4 times

Table 15.2: Savings on various sericulture activities through mechanisation

#	Activity/unit	Cost of operation (Rs.)		Cost savings through mechanization [(A-B)/A]x100
		Manual (A)	Machine (B)	
1	Land preparation (per ha)	3500	750	80 %
2	Cutting preparation (per 1000)	80	15	80 %
3	Intercultural operations (per ha)	2000	1200	40 %
4	Chemical application (per ha)	400	100	75 %
5	Shoot harvest (per MT)	500	125	75 %
6	Rearing house disinfection (per 300 dfls)	250	100	60 %
7	Leaf chopping (per day for 5000 dfls)	2000	200	90 %
8	Silkworm picking (per 100 dfls)	500	200	60 %
9	Cocoon harvesting (per 100 dfls)	600	150	75 %
10	Cocoon deflossing (per 100 dfls)	400	150	60 %
11	Tray washing (per 100 trays)	200	50	75 %

The mechanisation can help in enhancing the profitability in silk cocoon production as shown in Figure 15.1. It depicts the annual net earnings or profits from silk cocoon production per acre by different category on farmers based of extent of hiring of the workers. Here, it can be observed that the farmers who have sufficient family labour to do various works and do not hire any workers and may have profit of Rs. 1.94 lakhs/acre/year. Normally, the farmers having mulberry plantations upto 2 acres can be kept in this category. The profits reduce with increase in extent hiring of labours. A farmer with 50% work force as family members and hire balance 50% manpower will have net earnings of Rs. 1.38 lakhs/acre/year. The farmers having mulberry plantations above 2 acres and upto 5 acres come in this category. In Figure 15.1, there is a

very interesting thing to note that the farmers, who do not have any family labour and totally dependant on hired workers, can earn profit of around Rs. 83,000/acre/year. The big farmers having mulberry plantations above 5 acres are in this category. Most of these farmers are educated, employed and engaged in many works. They have sufficient finances to hire labours and invest in sericulture for rearing house, equipments and machines, transportation, communication, etc. This is a big strength of sericulture and for this reason why many young youths are attracted by sericulture. This is a good sign for Indian sericulture industry in the coming years.

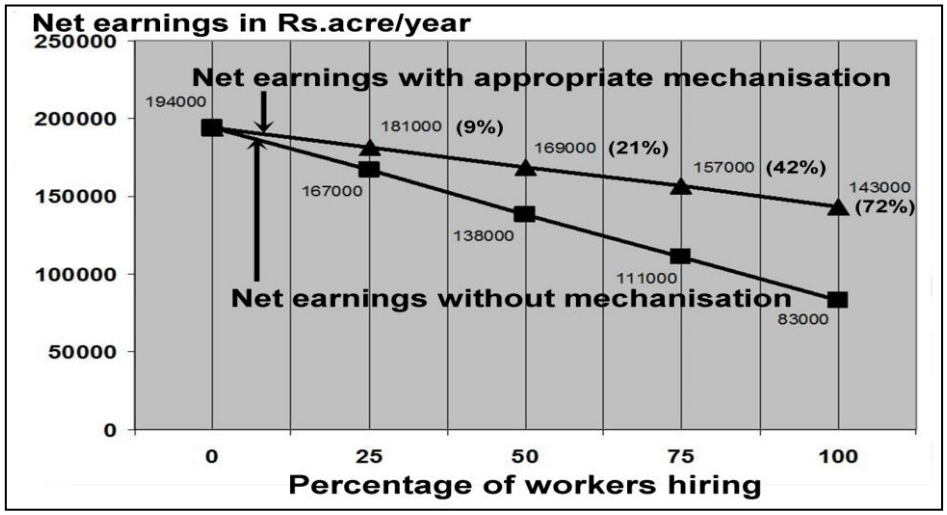


Fig. 15.1: Impact of extent of workers hiring on net earnings in mulberry silk cocoon production

During the year, 54 seri heaters, 3 cocoon cutting machines and 6 plastic mountage folding tools machines were fabricated and supplied.

16. REGIONAL SERICULTURAL RESEARCH STATION, ANANTHAPUR

MIP (A) 5001: Evaluation of elite mulberry varieties under semi–arid agro climatic conditions (August 2010 to March 2015)

M. Chandrasekhar (PI), M. A. Shanthan Babu and Ch. Satyanarayana Raju

Objective:

- To evaluate elite mulberry varieties under semi-arid agro-climatic conditions and to assess the growth and yield potential of elite mulberry varieties under semi-arid region of Andhra Pradesh.

Five elite mulberry varieties (G2, RC1, RC2, Taiwan, V-1 & Anantha) were evaluated under semi-arid agro-climatic conditions. Yield & growth data of the test varieties, were collected for two crops, which recorded highest yield of 26.4 kg in G2, compared to 21.2 kg in V1 and 19.4 kg in Anantha. Average data of two crops leaf yield (g) and leaf yield attributes of different mulberry varieties is given below.

Table 16.1: Leaf yield data of elite mulberry varieties (Mean of two crops)

Genotype	No. of branch	Total shoot length (cm)	No. of leaves/m	Total fresh wt. of shoot (g)	Fresh wt. of leaf (g)	Leaf/ shoot ratio	Leaf Moisture (%)	Leaf Moisture after 6 hrs (%)	MRC (%)	Leaf yield/ plot (kg)
MV1	6.42	876.05	21.0	1589.0	873.30	55.12	70.13	68.24	91.79	26.41
MV2	6.05	1078.55	21.0	1771.0	769.0	44.75	70.84	69.63	92.95	26.03
MV3	4.31	646.85	21.50	1205.50	587.80	50.10	68.41	67.24	94.0	20.68
MV4	5.70	730	21.45	1079.50	370.35	34.97	71.65	70.46	93.22	18.02
MV5	5.72	828.67	20.55	953.0	409.15	42.93	70.27	68.87	91.30	21.22
MV6	5.05	699.50	22.0	1052.50	510.30	49.93	68.61	67.87	92.30	19.37

VII. PROJECTS FUNDED BY EXTERNAL FUNDING AGENCIES AND COLLABORATIVE PROJECTS

(A) DBT FUNDED

A. 1 PIG 3502: Sustaining mulberry yields: Identification of QTLs conferring resistance to root rot disease by Linkage Disequilibrium mapping and trait introgression (Phase I) (June 2013 to 2015) - Funded by DBT

V. Girish Naik (PI), D. D. Sharma, V. Nishitha Naik, Rukmangada, JRF, R. Triveni, JRF

Objectives:

- Resistance response of mulberry germplasm to major causal fungus of root rot disease (in pot grown plants).
- Molecular characterization of germplasm accessions and finally identify the contrasts (resistant and susceptible).
- Develop mapping populations (by crossing of contrasts) in mulberry.

A total of 30 germplasm accessions were collected form the gene bank of CSGRC, Hosur and planted 35 accessions (including four pipeline varieties and V-1) in the cemented root structure for raising saplings. Among them, 17 were established in pots for root rot resistance screening. A total of 86 fungal isolates form root rot infected mulberry gardens were collected from the states of Andhra Pradesh, Tamil Nadu and Karnataka. Cultural and morphological characteristics of 78 fungal isolates were recorded. Twelve fungal isolates of *Macrophomina phaseolina* were mass multiplied for pathogenicity testing. Sufficient numbers of V-1 saplings were raised in the pots for pathogenicity test of fungal isolates. A total of 130 primer pairs (new microsatellite markers) were custom synthesized for characterization of mulberry germplasm. Out of the total, the PCR amplification of 24 primers was standardized.

A. 2 Establishment of Sub-Distributed Centres (Sub-DIC) under Biotechnology Information system network programme (BTIS Net) of Department of Biotechnology, Govt. of India.

Coordinators: B. B. Bindroo, R. Sumaty and S. K. Ashwath

Objectives:

- Maintain information repository of silkworm and mulberry germplasm resrouces.
- Develop and maintain database of silkworm and mulberry genome resources.
- Conduct training and workshops to create awareness in the area of bioinformatics.
- Guide students in project and dissertation work.
- Host database through website and provide online support for seri-biotechnology and seri-bioinformatics resources.

Eight databases *viz*., Silkprot, SilkTF, Mulberry genome database, Silk e-lab, database of DNA sequences for important plant genes in mulberry, soil info, database on mulberry pests and diseases and database on silkworm pests and diseases were updated and maintained. A two day workshop on Bioinformatics and its applications was held in which 26 scientists from CSRTI, Mysore and Regional stations participated. The workshop deliberated on basic genetics, silkworm and mulberry biotechnology, integration of proteomics and genomics, bioinformatics tools and techniques, IT applications, internet application using open source software, biological databases, structural biology, 3D structure of protein visualization and drug designing.

(B) PPV & FRA FUNDED

B. 1 PIB 3507: Development of Distinctness, Uniformity and Stability (DUS) descriptors for mulberry (*Morus* spp.) and their Validation (April 2013 to March 2016)

B. B. Bindroo, Director, **V. Girish Naik (PI),** Gandhi Doss, K. Rajashekar, T. Thippeswamy, Sowbhagya, SRF

Objectives:

- Develop and validate descriptors for mulberry.
- Identify distinctiveness and specific morphological, biochemical/molecular markers, and its stability.
- To characterize the extent of variability.
- Develop database for the descriptors of mulberry to add on to INDUS (India Database for DUS).

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The descriptors (48 characters - including morphological, reproductive, anatomical and growth parameters) have been initially short-listed and 16 mulberry varieties were identified for evaluation of descriptors. Data recording of 32 morphological characters were completed for validation of DUS test. Short-listed morphological characters (descriptors) will be used to demonstrate the distinctiveness, uniformity and stability.

(C) IINRG FUNDED

C.1 PPF 3500: Development of seri-lac culture model for income augmentation (June 2012 to December 2016) – In collaboration and funded by IINRG, Ranchi

B. B. Bindroo (Project Co-ordinator CSRTI, Mysore), R. Ramani, Project Co-ordinator IINRG, Ranchi), **K. Srikantaswamy (PI)** and S. Sen (SSC, CSRTI, Mysore), Mohanasundram (From IINRG, Ranchi).

Objectives:

- To work out the additional income generating out of lac culture and its economics in relation to mulberry leaf production.
- To asses the soil fertility status of the soil from lac plot and control.
- To find out the cross infectivity studies, if any, from mulberry to lac plant and *vice versa.*

Flemingia being a leguminous plant can resist and survive in long dry spells and having capacity to fix the atmospheric nitrogen. Root nodulation can take place very freely with native rhizobia and helps in BNF fixation. Considering the advantages associated with the perennial nature of shrub, attempt has been made to grow *Flemingia* as an intercrop with mulberry at RSRS, Chamarajanagara. The experiment was initiated at RSRS, FARM with existing mulberry tree plantation in wider spacing (8' X 8'). Three month old flamingia seedlings were transplanted in between mulberry tree plantation with spacing of 8' X 3'. Regular cultural operations like weeding, manuring and irrigation (once in three days) was carried out for the better establishment. About 450 seedlings were transplanted and assessed for its growth and biomass production after eight months of transplantation. The survival percentage was recorded around 55 %. The biomass production per plant ranged from 0.450 kg to 0.670 kg (including shoot + leaves) with the shoot length of 80 cm – 110 cm. It was observed that high temperature (>35^{o}C) followed by dry weather during the growth period coupled with high soil pH (> 8.6%) resulted in poor growth of the plants. Lac brood culture mass multiplied at IINRG was procured and inoculated on the lac host plants facilitating colonization for lac production. It was found that flamingia being a leguminous plant cuases soil acidification resulting in reduction of pH from 8.6 to 8.01, which is beneficial for mulberry growth.

Under irrigated conditions at farmer's plot, pre-requisite land preparation was carried out. V-1 saplings were raised and transplanted in wider spacing (8'X3' spacing). Plantation is under establishment. Flemingia seeds were also sown in polythene packets to raise the seedlings and around 75% survavabity was noticed in the nursery.

(D) JICA FUNDED

D. 1 Popularization of rotary mountages for quality cocoon production (April 2013 Continuous)

S. Purushotham (PI), B. B. Bindroo (Director), Ms. Eriko Kawaguchi, JICA Expert

Objective:
- To Popularize rotary mounatages to create awareness among bivoltine rearers for quality Cocoon production.

An extensive survey was conducted along with JICA expert Ms. Eriko Kawaguchi in AP, KA and TN and collected the feed back from the sericulturists for non adoption of rotary mountage technology for quality cocoon production. To redisseminate the technology the farmers were advised to follow nylon net collection method for collection of 50% of the mature larvae to reduce the drudgery during spinning time and go for mounting of 50% mounting on rotary mountages and the remaining on netrikes. With this method at least 50% quality cocoons are produced and in-turn gradable silk. In Karnataka, Andhra Pradesh and TN four clusters each were selected and provided with 30 rotary mountages and 800 sq ft of nylon net which can accommodate 100 dfls and a pair of pushers (Cocoon Harvesters). To popularize this method demonstration programmes were conducted at H. Kallhalli, K.R .Nagar cluster, T.N. Betta Pavagada cluster (Karnataka), TKN Pudur, Palani cluter (TN), Chinnari doddi and Tavadapalli villages in V. Kota and Palamner clusters (AP). Community mounting halls owners meet was organized at Gudisettypally, V. Kota in Andhra Pradesh for converting them to rotary mounting halls. Rotary mountage quality control committee meeting with manufacturers and the farmers was conducted at CSB, Bangalore.

VIII. CENTRAL OFFICE PROJECTS & PROGRAMMES (NATIONAL)

1. All-India Co-ordinated Experiment on Mulberry (AICEM) Phase-III

Duration June 2011 to June 2015

Zonal Co-ordinator B. B. Bindroo

Investigators T. Thippeswamy, **M. K. Prithvi Raje Urs (PI),** Rajashekar, K., S. Gandhi Doss, N. B. Chowdary (upto 31.05.2013) and Rekha, M.

Objective:
- To test mulberry varieties in different agro-climatic zones of Indai, for isolating the region specific variety.

Test centers in southern zone

State	Test centres
Karnataka	CSRTI, Mysore. Karnataka State Sericulture Research & Development Institute, Bengaluru. Research Extension Centre, Madivala.
Tamil Nadu	Research Extension Centre, Krishnagiri. Tamil Nadu Agricultrue University, Coimbatore.
Andhra Pradesh	Regional Sericultural Research Station, Anantapur. Research Extension Centre, Vikarabad. Research Extension Centre, Rayachotty. Andhra Pradesh State Sericulture Reseach & Development Institute, Hindupur.

The experimental plots were established in all the nine test centres in the southern zone with three test varieties [FYT-99/G-4, C-2038, Suvarna-2] and two check varieties [Vishala and V1]. After first synchronized pruning during June 2013, three crops data were recorded.

Leaf yield data of test varieties and checks at AICEM test centres of southern zone

Variety	Leaf yield kg/ha/crop								
	CSRTI, Mysore			RSRS, Anantapur			REC, Rayachoty		
	Crop 1	Crop 2	Crop 3	Crop 1	Crop 2	Crop 3	Crop 1	Crop 2	Crop 3
C-2038	7556	10632	8734	7603	5794	6597	9881	5744	9881
FYT-99/G-4	6956	8645	6955	8971	8762	10292	10122	6210	10112
Suvarna-2	6397	9164	7855	7165	6961	8150	8523	8817	8523
Vishala	6531	7470	7030	8840	8916	9796	8961	7281	8961
V1	6114	7296	6113	9185	9341	8791	7560	5492	7561
CD at 5%	NS	1749	1417	NS	722.3	1865	1624	1420	201
	REC, Vikarabad			APSSRDI, Hindupur			REC, Madivala*		
C-2038	7599	6910	6186	5894	-	-	5803	3869	-
FYT-99/G-4	7285	6467	5997	8774	-	-	4770	2988	-
Suvarna-2	6315	5739	5135	6916	-	-	4312	2743	-
Vishala	6870	6263	5624	8686	-	-	5916	3012	-
V1	7508	6855	6107	8760	-	-	4837	2498	-
CD at 5%	NS	NS	NS	650	-	-	750	NS	-
	KSSRDI, Bengaluru			REC, Krishnagiri			TNAU, Coimbatore		
C-2038	9404	10075	9414	6209	8078	5540	13650	14050	15689
FYT-99/G-4	8073	10631	12186	5857	8669	5355	15611	15413	13821
Suvarna-2	7731	9568	10112	5542	8459	5451	9554	10054	8542
Vishala	8250	10088	10053	5784	8479	5362	10589	11250	10648
V1	8099	10617	9846	5123	8126	5004	6654	7867	9653
CD at 5%	533	NS	NS	NS	NS	NS	1482	880	1235

**Crop 2 & 3 could not be harvested at Hindupur and Madivala due to severe drought.*

2. AIB 3498: Popularization of authorized silkworm hybrids among the farmers of South India

Duration November 2012 to October 2014

Zonal Co-ordinator B. B. Bindroo

Investigators The Director, CSR&TI, Mysore (Zonal Co-ordinator)
The Director, NSSO, Bangaluru,; The Director, CSTRI, Bangaluru;
The Director, APSSRDI,Hindupur; The Director, KSSRDI, Thalaghattapura, Bengaluru
Commissioners/Directors of Sericulture, Karnataka, Andhra Pradesh, Tamil Nadu and Maharashtra

Objective:

- To popularize the authorized hybrids for economical exploitation.

The parental dfls silkworm breeds, CSR16 and CSR17 were supplied by CSR&TI, Mysore to NSSO for raising of seed cocoons and subsequent generation of hybrid seed. A total quantity of 3,50,350 dfls of CSR16 x CSR17 were tested at different locations of Karnataka, Andhra Pradesh, Tamil Nadu and Maharashtra and recorded an average cocoon yield of 64.17kg /100 dfls. The state wise break up shows that a total of 54,750 dfls were distributed to 192 farmers in Karnataka and the hybrid recorded an average cocoon yield of 63.89 kg /100 dfls. In Andhra Pradesh, a total quantity of 2, 02,200 dfls were distributed to 684 farmers and the hybrid recorded an average cocoon yield of 62.76 kg /100 dfls. In Tamil Nadu, a total quantity of 85,750 dfls were distributed to 480 farmers and the hybrid recorded an average cocoon yield of 67.92 kg /100 dfls. In Maharasthra, a total quantity of 7650 dfls were distributed to 22 farmers and the hybrid recorded an average cocoon yield of 61.25 kg /100 dfls. The hybrid recorded the silk quality of 2A to 3A grade.

Field performance of CSR16 x CSR17

Sl. No.	State	No. of Dfls	No.of farmers	Actual yield (kg)	Yield/ 100 Dfls	Cocoon weight (g)	Shell wight (g)	Shell %	Rate/ Kg (Rs)
1	Karnataka	57750	208	126906.10	65.85	1.690	0.341	20.2	379
2	Andhra Pradesh	202200	684	36052.88	62.76	1.821	0.379	20.8	345
3	Taminadu	85750	480	58244.27	67.92	1.849	0.391	21.1	376
4	Maharashtra	7650	22	4685.63	61.25	1.625	0.327	20.1	-
	Total/Average	**350350**	**1390**	**225888.88**	**64.48**	**1.746**	**0.360**	20.6	**367**
	CSR2xCSR4(C)	246805	1019	151859.10	61.53	1.756	0.367	20.9	370

C- Control hybrid

IX. ON STATION TRIALS CONDUCTED BY RSRSs

1. RSRS Kodathi, Karnataka

a. Evaluation of the resource constraint varieties RC1 and RC2 at the semi arid conditions of RSRS, Kodathi

Three crops growth and yield data were recorded and the leaves were utilized for rearing. The consolidated yield data of 5 crops were sent to CSRTI, Mysore. The results indicated that there is no significant difference in the leaf yield among the three varieties RC1, RC2 & K2). However, the growth parameters like, height of the plants, number of leaves, branches and leaf moisture percentage recorded a significant variation among the three varieties.

b. Control of root rot disease in different mulberry varieties by Navinya application

Plantation with four popular varieties *viz.,* V1, S36, K2 & RFS 175 in paired row system is being maintained with appropriate cultural operations. Observation for the incidence of root rot disease was recorded for three crops and leaf was utilized for farm rearing. Navinya was applied to all the plants for all crops. It was observed that out of four varieties, the variety V1 is more susceptible (25%) and variety RFS175 (8%) is more resistant to root rot disease. The Navinya is very effective and the incidence of root rot disease was reduced from 5% of the previous year to 2%.

c. Demonstration of Technologies

Demonstration plots were maintained on integrated nutrient Management package (INM) and with triple row spacing (90+90+120) x (90+90+120) for large scale farming community and composting and vermi-composting pits were maintained appropriately for the demonstration of the technologies for the farmers visiting the station. A total of 2749 farmers/ students/ officials who visited the station during the period were sensitized on the advantages of these technologies.

d. Three-way crosses

3 three-way cross bivoltine hybrids were evaluated during June-July, Aug-Sept and Oct-Nov, 2013. The test hybrid, FC3 x CSR17 was superior in terms of ERR by No. (9450), weight (16.1 kg) and cocoon weight (1.741 g), filament length (873.4 m) and raw silk % (16.1) when compared to 8729, 14.6 kg, 1.717g ,781.3 m and 15.3 % in case of control, FC1 x FC2 respectively.

e. Bivoltine hybrids

One trial of bivoltine hybrids G11 x G19 and 2C x 4S, DH1, DH2 along with control hybrids FC2 x FC1, (CSR6 x CSR26) x (CSR2 x CSR27) and CSR2 x CSR4 were evaluated. The double hybrid, G11 x G19 recorded the highest ERR number (9832), ERR wt. (17.2 kg) when compared to 6704 and 10.1 respectively in the control hybrid.

f. Bivoltine Double hybrids

One trial of double hybrids *viz.,* D2 x D3, D1 x D2 (CSR2 x CSR50) x CSR51 x CSR26), DH-1, DH-2, Double hybrid (Krishnaraja) and CSR2 x CSR4 as control hybrids received from SSBS, Coonoor were evaluated. Highest ERR No. of 9600, ERR wt. of 17.2 kg, cocoon weight of 1.745 g was found in D2 x D3 when compared to 7500, 12.2 kg, 1.675 g respectively in the control.

g. Multi x bi hybrids

One trial of improved multi hybrids NDV6 x CSR51 and L14 x CSR50 were evaluated during the month of Oct. - Nov. 2013 along with control hybrids L14 x CSR2. The hybrid L14 x CSR50 was found to be superior in terms of highest ERR No. (9824), ERR wt. (17.7 kg), cocoon weight (1.880 g), shell weight (0.375 g), Shell % (19.95), filament length (721.4 m) and raw silk % (15.2), while in the control hybrid, L14 x CSR2, the values were 9600, 16.9 kg, 1.856 g, 0.325 g, 19.1% , 715 m and 13.5 % respectively.

2. RSRS Chamarajanagar, Karnataka

a. Evaluation of RC1 and RC2 genotypes under water stress condition

Demonstration of RC1 and RC2 was taken up with two farmers during the period under report. One farmer harvested two crops and another farmer harvested one crop. Average of three crops leaf yield data indicated that, the variety RC1 yielded 2193 (18.93% improvement) kg/ac/crop and RC2 gave 2013 (9.17% improvement) kg/ac/crop where as check variety- S13 gave 1844 kg/ac/crop. Cuttings of RC1 and RC2 supplied to KVK, Haradanahalli and Government Silk Farm, Talawadi, DoS, Tamil Nadu for distribution to farmers. Saplings are raised in nursery beds at RSRS, Chamarajanagar for distribution to farmers.

b. Integrated nutrient management package for mulberry cultivation

The TOT was implemented with 10 farmers having V-1 mulberry garden in IJS/3'x3' spacing under irrigated condition. Inputs were supplied @ 2 kg Azotobacter, one kg PSB and one liter Poshan per acre for each crop and one time supply 8 kg green manure seeds and 200 kg neem oil cake.During the period under report thirty crops leaf yield data was recorded from both INM and control plot covering ten farmers field. Pooled data indicated that the INM plot shown higher leaf yield 9735kg/crop/ha over the control (8921kg/crop/ha) with an leaf yield improvement of 9.1%. The average cocoon yield was recorded as 61.4 kg/100 dfls in INM with an improvement of 18.1 % over bench mark.

c. Testing of new three way cross bivoltine hybrids

Two on Station Trials (OST) were conducted with FC1 x CSR2 and FC3 x CSR17 keeping FC1 x FC2 and CSR2 x CSR4 as control. The data indicated that the three way cross hybrid FC1 X CSR2 and FC3 x CSR17 had shown higher ERR by number (9320 and 9567) and by weight (14.677 and 14.773 kg) in comparison to control hybrid FC1 x FC2 and CSR2 x CSR4. Similarly, the new hybrids had shown comparatively higher cocoon wt., shell wt. and shell ratio % than the control hybrids.

d. Demonstration of efficacy of uzi fly parasitoid *Nesolynx thymus* for control of uzi fly

Regular mass production of *N. thymus* on housefly pupae was undertaken at RSRS and periodically parasitoids were released in field during rearing period. The data were collected before and after release to assess the percentage of reduction of infestation. During 2013-2014 a total of 5200 ml. (104 packets) *N. thymus* were cultured on housefly pupae and 3300 ml was supplied to 37 farmers under TOT. The initial infestation of uzi fly was 14.11% and it was reduced to 6.27% after release of *N. thymus*. Economics was worked out based on the feed back data collected from farmers and it was found that a net profit of Rs.1248.00 was obtained for 100 dfls.

e. Demonstration of efficacy of lady bird beetles for control of tukra mealy bug

Mass production of *S. coccivora* through culture of mealy bug in pumpkin was initiated at RSRS. 32 boxes of lady bird beetles *(C. montrozieuri / S. coccivora*) were released in 18 farmer's

garden and in RSRS farm. The initial infestation recorded was 20.67% before release of bio control agents which had reduced to 6.83% after release of lady bird beetles. Economics was worked out based on the feedback data collected from farmers and it was found that a net profit of Rs.416.00 was obtained per crop per acre. The cost benefit ratio was 1:1.81.

3. RSRS Ananthapur, Andhra Pradesh

New bivoltine three-way cross hybrids, FC3 x CSR17 and FC1 x CSR2 were tested along with the controls, FC1 x FC2 and CSR2 x CSR4. The hybrid, FC1 x CSR2 showed the highest ERR No. (9364), ERR wt.(18.4 kg), cocoon weight (1.965 g) and shell weight (0.427 g), when compared to 9280, 17.8 kg, 1.926 g, 0.411g) respectively in FC1 x FC2. The post-cocoon traits did not vary significantly. Further four bivoltine x bivoltine hybrids, (G11 x G19, 2C x 4S, FC2 x FC1 and CSR2 x CSR4 were tested.. G11 x G19 showed the highest ERR No. (9396) and weight (16.1 kg) when compared to the control.

4. RSRS Salem, TamilNadu

a. Testing of New Three Way Cross Bivoltine Hybrids

Three trials completed with new three way cross bivoltine hybrids *viz.,* FC1 x CSR2, FC3 x CSR17 along with CSR2 x CSR4 and FC1 x FC2 as Control hybrids. Results of the trials indicated that FC1 x CSR2 has performed better with respect of ERR no. (9580), ERR wt. (18.4kg), SCW- 1.943g, SSW-0.423 followed by FC3 x CSR17. Regarding the reeling parameters, FC1 x CSR2 was superior for reelability (88.38%), AFL (1141.45m), NBFL (1010.13m) and FC3 x CSR17 was superior for Renditta (5.84) and RSR (76.18%) compared to control hybrids.

b. Testing of Improved Cross Breeds

Two trials completed with two improved cross breeds *viz.,* L14 x CSR50, NDV6 x CSR51 along with L14 x CSR2 and PM x CSR2 as control hybrids. L14 x CSR2 (Control) was superior for ERR No. (9513), ERR Wt. (18.02kg), SCW- 1.991g, SSW – 0.44g and SR (22.1%) followed by NDV6 x CSR51. First trial reeling data indicated that L14 x CSR50 was superior with AFL (1168.67m), NBFL (892.51m), denier (2.40), Renditta (5.38) and RS (18.59%) followed by NDV6 x CSR51**.**

c. Testing of bivoltine hybrids developed by SSBS, Coonoor

a) First trial completed with new bivoltine double hybrids developed by SSBS, Coonoor *viz.,* DH1, DH2 and DH3 along with FC1 x FC2 as control. Results of the trial indicated that the rearing performance of DH1 was superior for ERR No. (9360), ERR Wt. (18.32kg) and SCW (1.954g) followed by DH2 compared to control.

b) First trial completed with new bivoltine single hybrid (D2 x D13) and double hybrid (D1x D2) x (D13 x D11) developed By SSBS, Coonoor along with CSR2 x CSR4 and FC1 x FC2 as control hybrids.

d. Testing of new bivoltine breeds developed through marker assisted selection by SBRL, Bangalore

One trial completed with three bivoltine breeds developed through marker assisted selection for BmNPV tolerance by SBRL, Bangalore. Among the three breeds, MASN6A has performed better with fecundity (571), ERR No. (8990), ERR Wt. (11.973kg), SCW (1.399g), SSW (0.32g) and SR (21.59%) followed by MASN9.

X. SERICULTURE EXTENSION

G.S. Vindya, Kanika Trivedy, S.B. Nagaraja, B. Gangadhara, G.S. Geetha, Mahima Santhi and A.S. Suma

1. Cluster Promotion Programme (CPP)

The Cluster Promotion Programme (CPP) is implemented in Southern zone *viz.,* Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra and Madhya Pradesh from 1st April, 2013 in 106 clusters. The clusters in Southern zone are categorized into 55 mother clusters and 51 satellite clusters. The Director, CSRTI, Mysore is the south zone coordinator.

In the cluster promotion approach, a cluster of villages and families located nearby are selected and adopted so as to have area/mass effect of the improved technologies introduced under the programme and the programmes are manageable by the limited scientists and extension workers jointly with the active involvement of local stakeholders. The main objective of establishing these clusters is to produce 5000 MT of gradable Raw silk by the end of XII plan. The projected raw silk output for 2013-14 was 1400.59 MT for southern states including Madhya Pradesh.

During the year, south zone clusters have achieved the target in raw silk production. The cumulative raw silk produced is 1420.81 MT against the target of 1400.59 MT. The Tamil Nadu and Andhra Pradesh states have achieved cent percent target in DFLs distribution in CPP. A total of 142.41 lakh DFLs were distributed to the farmers of the clusters against the target of 168.35 lakh with an achievement of 84.59%. In the clusters 8809.050 MT of cocoons were produced with an average yield of 68.31 kg for 100 DFLs. In these clusters 12341 farmers had newly planted 16515.12 acres.

Progress report of CPP of southern zone for the year 2013-14

States	Annual Target (Lakhs)	Dfls brushed (Lakhs)	% of Achie-vement	Actual cocoon yield (MT)	Yield/ 100 (kg)	Rate/kg (Rs)	New plantation		Estimated Raw silk
							No. of Farmers	Area (Ac)	
Karnataka	78.25	56.55	73.68	3360.2	65.8	363	7957	10829	542.0
Maharashtra	8.35	6.37	76.26	357.1	63.2	320	660	787	57.6
Andhra Pradesh	36.70	36.84	100.3	2279.0	66.6	366	2050	2608	367.6
TamilNadu	41.05	41.06	100.0	2733.3	74.4	391	994	1606	440.9
Kerala	2.00	0.27	13.62	20.4	76.4	358	30	35	3.3
Madhya pradesh	2.00	1.33	66.49	58.7	52.9	229	650	650	9.5
Total/Avg.	**168.35**	**142.41**	**84.59**	**8809.0**	**68.31**	**-**	**12341**	**16515**	**1420.9**

2. Visitors'Service

The Institute is one of the tourist attraction places in Mysore, especially for the students of biological sciences, farmers from sericulture background and foreign visitors. During the period, the division has co-coordinated the visit of 5416 farmers, 2395 students, and 149 others including foreigners to the institute covering different laboratories and interacted with scientists and they have utilized the KIOSK for information.

Month	Farmers	Students/Trainees	Others/Foreigners
April 2013	02	198	-
May 2013	192	-	-
June 2013	85	-	-
July 2013	117	57	98
August 2013	424	56	-
September 2013	702	414	17
October 2013	722	120	17
November 2013	1137	213	
December 2013	591	685	17
January 2014	378	248	-
February 2014	578	56	-
March 2014	488	348	-
Total	**5416**	**2395**	**149**

3. Mass Media Programmes

Sericulture Farmer's Workshop

Central Sericultural Research and Training Institute (CSRTI), Central Silk Board, Mysore jointly with Department of Sericulture, Government of Karnataka organized one day workshop on 'Sericulture for Sustainable Livelihood' for the farmers on 28th January 2014 at its campus to enlighten them on the recent technological developments made for benefits of sericulture Industry. Chairman, Member Secretary and Board Members of CSB graced the Sericulture Farmers' Workshop at CSRTI, Mysore.

A large number of farmers (1863) representing all the 30 districts of Karnataka state, besides hundreds of DOS officials, sericulture entrepreneurs, representatives from NGO participated in the workshop. A host of dignitaries including Shri N.S. Bissegowda, Hon'ble Chairman, Central Silk Board, Bangalore; Padmabhushana Prof. M. Mahadevappa, Former Vice Chancellor, UAS Dharwad and President, Former Vice Chancellors Forum; Mrs. Ishita Roy, I.A.S., Member Secretary, CSB, Bangalore; Shri B.C. Umesh Babu, Board Member, CSB, Bangalore; Shri M.P. Lakshmikanth, Board Member, CSB, Bangalore; Shri R.H. Jayarama Reddy, Board Member, CSB, Bangalore. Shri R.K. Ramakrishnappa, Board Member, CSB, Bangalore; Shri Arahunase, JDS, DOS Karnataka; Shri K.B. Shanthamurthy, DDS, DOS; Dr. R.K. Datta, Dr. M.N. Narasimhanna, Dr. N.B. Vijaya Prakash, Ex-Directors, CSB; Mr. M.N.S. Iyengar, Ex-Joint Director and Dr. H.K. Basavaraja, Ex-Scientist-E, CSB were present at the event.

As a part of workshop, a sericulture exhibition and on spot demonstration of new technologies were organized for the benefit of visiting farmers. The new technologies/ products/ equipments/ machineries developed by the Institute were showcased. Other sericulture research institutes *viz.,* CSTRI, KSSRDI and APSSRDI also participated in workshop and exhibited their technologies.

On the same occasion many new technologies/products developed by the Institute were released for the popularization among sericulture farmers. The main technologies/products released were:

1. Sericulture Technology (Kannada booklet).
2. Proceedings of Golden Jubilee Seminar of CSRTI, Mysore - 2011
3. G4 Mulberry Variety
4. Bivoltine Silkworm Hybrid (Chamaraja)
5. Bivoltine Silkworm Hybrid (Jayachamaraja)
6. Multi x Bi Silkworm Hybrid (Mysore Gold)
7. Sericulture Technology (Pamphlets in English)
8. Sericulture Technology (Pamphlets in Kannada)

Feed back collected from the participants of Krishi Mela

a. Profile of the participants: Majority of the farmers who attended the Krishi Mela were male (83.42%), 68.21% of the respondents were of middle age group (36-56 years), while 19.91 % belonged to young age group (below 36 years). About 77.95% were educated from primary to high school levels while only 12.40% were illiterates and 9.43 % graduates. The knowledge level was medium in 60% and high in 30% of the farmers. Among the participants, 51.71% belonged to general category, while 22.97 % were from SC/ST category. Majority of the sericulture farmers were from BPL group (90.11%) with an experience of 2-5 years (32.62%). Further about 46.40% of the sericulture farmers were carrying out silkworm rearing in separate rearing house, where as 53.59% rear in dwelling cum rearing houses. About 50% of farmers were brushing

50-150 dfls/crop, while, 27.68% brush 200-250dfls / crop. The average land holding was 3.45 acre iunder rainfed and 2.12 under Irrigated. The average number of crops per year was five with an average annual income of Rs 1.34 lakhs/year.

b. Impact: It was found that there was a considerable increase in knowledge levels of farmers attending krishi mela in respect of technologies like disinfection of rearing house, use of bed disinfectants, mulberry plant spacing, soil testing, timely application of fertilizers etc. Further, on spot technology demonstrations and exhibition of the products/exhibits have also elevated the farmers knowledge levels. Arrangements for the Krishimela were rated as good by 68.82 % of the farmers, as excellent by 14.83% while very few (5.85%) opined that it was average.

4. Model of commercial CRC, of SEEM Division

The main aim of model chawki rearing center is to popularize chawki-rearing concept through private entrepreneurs to promote bivoltine sericulture in India. It is also utilized as informal school for learning chawki-rearing techniques particularly egg handling, mass brushing, bed spacing, temperature and humidity maintenance etc. During the period, a total of 85650 dfls brushed in 35 batches and distributed the chawki worms to adopted farmers. The farmers recorded an average yield of 67.71 kg/100 dfls with an average cocoon rate of Rs 358 /kg. An average return/100 dfls recorded was Rs 24241. The total revenue generation recorded was of Rs. 5,01,463/- through sale of chawki worms. Besides, a total of 357 farmers were trained in chawki rearing technology at the main institute.

Chawki rearing details of bivoltine hybrids

Month	No. of batch	Qty. of layings	Hatch-ing %	No. of farmers covered	Yield/ 100 dfls	No of trainees trained	Rate/ kg	Revenue generation (Rs.)
April 2013	3	8300	88.75	72	68.55	11	359	37363
May 2013	3	10000	91.96	78	64.55	21	344	60000
June 2013	3	11500	91.85	78	65.00	12	313	69000
July 2013	3	13000	92.72	81	62.29	35	359	78000
August 2013	2	4500	88.35	32	70.08	61	360	27000
September 2013	3	7500	95.45	62	69.05	26	332	45000
October 2013	3	5800	92.41	47	70.13	19	366	34800
November 2013	3	4500	92.93	35	75.10	04	392	27000
December 2013	3	5000	89.50	43	73.31	65	402	30000
January 2014	3	5500	93.29	40	77.75	36	397	33000
February 2014	3	4000	93.66	32	67.50	38	371	24000
March 14	3	6050	93.63	46	67.96	29	364	36300
Total/Avg	**35**	**85650**	**91.55**	**646**	**67.71**	**357**	**358**	**501463**

5. Workshop on Role of CRCs in bivoltine silk production

Central Sericultural Research and Training Institute, Mysore organized a Workshop on ***Role of CRCs in bivoltine silk production*** on 13th December 2013 at CSRTI, Mysore. The main objective of this workshop was to provide a platform to the owners of Chawki Rearing Centres to discuss and exchange their views, problems and prospects for supply of quality chawki worms and to interact with the scientists of the institute, seed producers and the DOS officials.

Ms. Ishita Roy, I.A.S., Member Secretary, Central Silk Board, Bangalore, representative of Department of Sericulture, Karnataka and Tamil Nadu, Dr. B.B. Bindroo, Director, CSRTI, Mysore and Dr. B.S. Angadi, Director, NSSO, Bangalore, the owners of Chawki Rearing Centres, Cluster Development Facilitators of Central Silk Board along with DOS officials from Karnataka, Andhra Pradesh and Tamil Nadu were present in the workshop.

A technical booklet on ***"Commercial Chawki Rearing –Exploring New Horizons"*** was released during the occasion by CEO and Member Secretary, CSB, Bangalore. On the same occasion technical presentations by scientists were also organized for the benefit of CRC owners.

Post lunch session started with group discussions among CRC's owners, DOS and CSB representative and followed by interactive session. Total 6 groups were constituted, first three groups were from Karnataka, 4th & 5th groups from Tamil Nadu and 6th Group was from Andhra Pradesh.

All the groups discussed on the 15 points of agenda of workshop and gave their recommendations. These general recommendations were forwarded to central office for further necessary action.

6. Supply of seed cuttings and saplings of improved mulberry varieties

Sl. No.	Name of centre	Mulberry area (ha)
1	REC Amaravathi	77.70
2	REC SU Osmanabad	17.00
3	REC SU Burhanpur	202.00
4	REC SU Maddur	61.93
5	REC Parbhani	57.14
6	REC Baramathi	52.50
7	REC SU Shivamogga	87.00
8	REC SU Jalna	170.00
9	REC Hoshangabad	60.70
10	REC Aurangabad	56.85
	Total	**842.82**

7. Performance of CSR hybrids in the command area of RSRSs

#	Name of centre	No. of rearers	No. of dfls reared	Average cocoon yield (kg/100 dfls)
1	REC Amaravathi	715	119900	62.38
2	REC SU Osmanabad	144	31850	74.74
3	REC SU Burhanpur	406	40600	53.61
4	REC SU Maddur	969	220945	60.74
5	REC Parbhani	231	37500	69.67
6	REC Baramathi	554	116450	67.73
7	REC SU Shivamogga	148	55890	67.00
8	REC SU Jalna	646	103550	63.38
9	REC Hoshangabad	51	10680	59.93
10	REC Aurangabad	281	180900	63.75
	Total/Avg.	**4145**	**918265**	**64.30**

8. Income generation at RSRSs and nested units (Rs. in lakhs)

Name of centre	Soil analysis charges	Sale of cocoons	Sale of cuttings/ saplings	Chawki Charges	others	Total
SSBS, Coonoor	-	1.680	-	-	0.266	1.95
RSRS Kodathi	0.034	2.107	-	-	0.037	2.18
REC Madivala	-	0.330	0.006	-	0.140	0.43
REC Chitrdurga	-	-	-	1.206	-	1.21
REC Bidaraguppe	-	0.049	-	-	0.121	0.17
REC Koppal (SU)	-	0.163	-	0.371	0.011	0.55
RSRS Chamarajanagar	-	0.779	0.125	0.945	-	1.80
RSRS Ananthapur	0.018	1.310	0.550	0.063	0.760	2.71
RSRS Salem	0.060	0.680	0.210	0.830	0.130	1.91
REC Aurangabad	-	-	-	-	0.039	0.04
Total	**0.112**	**7.098**	**0.891**	**3.415**	**1.504**	**12.95**

9. Extension Communication programmes conducted by RSRSs and nested units

Name of centre	GD	FS	EX	FD	AP	EP	DE	FM	WS/SE	ST	Total
CSRTI, Mysore	48	-	-	14	11	-	-	1	1	-	75
RSRS Kodathi	37	-	-	5	18	1	19	1	-	5	86
REC Chitrdurga	3	-	-	2	1	1	-	1	-	1	9
REC Madivala	5	-	-	3	1	1	-	-	-	-	10
REC Bidaraguppe	6	-	-	1	-	1	3	-	-	1	12
REC Kanakapur (SU)	6	-	-	2	-	-	7	-	-	1	16
REC Koppal (SU)	4	-	-	-	1	1	-	-	-	-	6
RSRS Chamarajanagar	9	9	1	5	-	-	-	-	-	1	25
REC Kinankanhalli	3	3	1	2	-	-	-	-	-	1	10
RSRS Ananthapur	1	-	-	-	-	-	-	-	1	-	2
REC, Kalyandurgam	4	-	2	2	9	-	-	-	-	1	18
REC, Rayachoti	-	2	1	1	2	-	-	-	-	1	7
REC, Venkatagirikota	4	2	1	4	4	1	-	-	-	1	17
REC, Vikarabad	3	2	1	-	2	-	-	-	-	1	9
REC, SU, Penukonda	2	2	1	2	3	1	-	-	-	1	12
CPC, Hindupur	6	2	1	2	2	1	-	-	-	1	15
CDC, Palamaner	3	2	1	2	4	1	-	-	-	1	14
RSRS Salem	5	-	2	-	1	2	4	-	1	2	17
REC, Gobichettipalayam	8	-	2	2	3	1	2	-	0	-	18
REC, SU, Trichy	4	-	1	3	4	1	3	-	-	1	17
REC, SU, Avinashi	3	-	-	-	1	-	2	-	-	-	6
REC, Krishnagiri	4	4	-	2	2	1	2	01*	-	-	15
REC, SU, Berigai	5	-	-	1	2	1	3	-	-	-	12
REC, Samayanallur	6	-	2	2	3	1	2	01*	-	-	16
REC, Udumalpet	6	-	3	2	3	2	2	01*	-	-	18
REC, SU, Srivilliputhur	6	-	3	2	3	-	3	-	-	1	18
REC, SU, Vaniyambadi	4	-	-	2	2	-	-	-	-	-	8
REC, Palakkad	4	-	1	2	2	1	-	-	-	1	11
REC, SU, Kalpetta	5	-	1	2	2	1	-	-	-	1	12
REC, Amravati	13	-	3	4	3	-	2	-	-	-	25
REC, Baramati	7	7	1	3	3	3	-	-	-	2	26
REC, Parbhani	3	-	-	2	5	-	1	-	-	1	12
REC, Hoshangabad	8	-	-	4	-	1	-	-	-	-	13
REC, SU, Aurangabad	12	-	-	1	6	-	3	-	-	-	22
REC, SU, Maddur	15	-	-	3	-	7	-	-	-	-	25
REC SU Jalna	2	-	-	-	2	-	1	-	-	-	5
REC SU Burhanpur	4	-	-	3	-	1		-	-	-	8
REC, SU, Shivamogga	4	-	-	-	3	-	6	-	-	-	13
Total	272	35	29	87	108	32	65	3	3	26	660
No. of Farmers sensitized	**4888**	**995**	**8047**	**3760**	**4246**	**2295**	**2295**	**3224**	**375**	**804**	**30969**

GD: Group discussion, FS: Film show, EX: Exhibition, FD: Field day, AP: Awareness programme,
EP: Enlightenment programme, DE: Demonstration, FM: Farmers meet, WS: Workshop; ST: Study tour.
*Capacity Building Programme (CBP)

XI. HUMAN RESOURCE DEVELOPMENT

S. D. Sharma, Parameswara, S. N. Pallavi, S. Lakshmanan, V. N. Sudha, R. S. Katiyar, Vineet Kumar, A. S. Suma. and R. Bhagya

a. Management Development Programme (MDP)

Sl. No.	Name of the course	Duration	Number of persons trained
1	Chawki Rearing	10 days	35
2	Mechanization in Sericulture	4 days	13
3	Extension Managemnt	4 days	12
4	Refresher Course	4 days	56
	Total		**116**

b. Technology Up-gradation Programme (TUP) - for sericulturists

Sl. No.	Name of the course	Duration	Number of persons trained
1	Chawki rearing for farmers	8 days	146
2	Late age silkworm rearing for farmers	10 days	27
3	Mulberry Cultivation	6 days	23
4	Integrated pest and disease management for farmers	6 days	23
	Total		**219**

c. Training under Integrated Skill Development Scheme (ISDS)

Sl. No.	Name of the course	Duration	Persons trained
1	Commercial chawki rearing	15 days	67
2	Mulberry cultivation	15 days	14
3	Cocoon handicrafts	15 days	50
4	Quality bivoltine cocoon production	15 days	42
	Sub-Total (CSRTI, Mysore)	-	173
5	RSRS, Salem	15 days	105
6	RSRS, Chamarajanagar	15 days	60
7	RSRS, Ananthapur	15 days	105
8	RSRS, Kodathi	15 days	75
	Total		**518**

d. International Training Programme

Sl. No.	Name of the course	Duration (days)	Persons trained
1	Race maintenance, silkworm rearing and extension management for officials from Bangladesh	33	21
2	Sericulture technology for officials from Afghanistan	10	21
	Total	**-**	**42**

Trainees from Bangladesh

Trainees from Afghanistan

e. Programme on request

The training division gets request from sericulturists, unemployed youth, Non Government Organizations, Universities, Departments of sericulture, etc., to train their staff in improved sericultural technologies from time to time. Accordingly, the additional programmes were planned and **644** candidates were trained under various request-based programmes.

Sl. No.	Name of the course	Duration (days)	Sponsoring agency	No. of persons trained
1	Orientation Training programme (Officials)	3	CSB/DOS	70
2	Extension Management (Officials)	6	DOS, MP	10
3	Intensive Bivoltine Training (Officials)	35	DOS, Manipur	41
4	Sericulture Technology (Officials)	8	DOS, MP – 9, UAS, Chintamani -33 Vocational lecturers, AP -41	83
5	Bivoltine Sericulture Training to PGDS trainees from CSRTI, Berhampore	5	CSRTI, Berhampore	29
6	For Cluster Facilitators (Officials)	3	CSB/DOS	192
7	Chawki Rearing (officials)	8	DOS, MP	10
8	Jointly organized by CSB, Bangalore and MANAGE, Hyderabad for managerial staff	4	MANAGE, Hyderabad	25
9	Awareness Programme (Officials)	4	DOS, Bodoland	10
10	Training in Pest and disease management (Officials)	8	Padmavathi Mahila Vishwa Vidyalaya, Tirupathi, AP	2
11	Innoculum preparation of BmNPV (Officials)	4	CSRTI, Pampore	1
12	Late Age Rearing (Farmers)	10	DOS, Maharashtra	13
13	Chawki Rearing (Farmers)	8	DOS MP – 9, DOS Maharashtra-39	48
14	Mulberry Cultivation(Farmers)	5	DOS, MP	10
15	Intensive Training in Bivoltine Sericulture (ITBS) (Farmers)	90	Farmers, Dharwad	2
16	Awareness Programme (Farmers)	5	DOS MP – 11, DOS Assam - 25	36
17	Commercial Chawki Rearing under New CSB Seed Act (Farmers)	90	Entrepreneurs in Commercial Chawki Rearing	37
18	Intensive Bivoltine Training (Farmers)	35	JSSKVK, Suttur,Mysore–5, Farmer-1	6
19	Silk Production Technology (Farmers)	5	DOS, Uttar Pradesh	19
		Total		**644**

f. Training of stakeholders at RSRS and nested units

Sl. No.	Name of the course	Number of persons trained
RSRS, Salem & nested units		
1	Disinfection and disease management	255
2	Mulberry crop protection	240
3	Integrated nutrient management in mulberry	255
4	Silkworm crop protection	240
5	Soil fertility management	240
6	Training under ISDS	105
	Total	**1335**
RSRS, Chamarajanagara & nested units		
7	Disinfection and disease management	30
8	Mulberry crop protection	30
9	Organic farming	45
10	Silkworm crop protection	30
11	Training under ISDS	60
	Total	**195**
RSRS, Anantapur & nested units		
12	Disinfection and disease management	180
13	Mulberry crop protection	135
14	Organic farming	165
15	Silkworm crop protection	120
16	Soil fertility management	60
17	Training under ISDS	105
	Total	**765**
RSRS, Kodathi & nested units		
18	Disinfection and disease management	405
19	Mulberry cultivation and disease management	255
20	Integrated nutrient management in mulberry	225
21	Soil fertility management	30
22	IPM of silkworm and mulberry pests	45
23	Training under ISDS	75
	Total	**1035**
Units directly administered by CSR&TI, Mysore		
24	Disinfection and disease management	30
25	Mulberry cultivation and disease management	158
26	Integrated nutrient management in mulberry	30
27	Disinfection and disease management	60
	Total	**278**
	Grand Total	**3608**

g. Practical training in bivoltine silkworm rearing

To support all the above courses, bivoltine silkworm rearings were organized in 8 batches. A total of 800 dfls were brushed with an average hatching percent of 92.18, single cocoon weight of 1.919, Single shell weight of 0.404 and shell percentage of 21.39. The average cocoon yield obtained was 82.44 kg / 100 dfls with an average rate of Rs. 419.25 per kg cocoons in Ramanagaram cocoon market.

Season	No. of dfls	Hatch-ing (%)	Cocoon weight (g)	Shell weight (g)	Shell (%)	Yield/ 100 dfls	Rate /kg (Rs.)
26.03.2013	100	92.40	1.982	0.441	22.25	71.74	428.00
15.05.2013	100	95.40	1.942	0.407	20.90	78.68	460.00
25.06.2013	100	90.00	2.039	0.410	21.87	83.00	278.00
12.08.2013	100	89.67	2.105	0.572	22.47	81.04	535.40
30.09.2013	100	91.00	1.927	0.392	20.44	72.27	400.10
18.11.2013	100	95.04	1.698	0.370	22.47	82.11	367.10
08.01.2014	100	90.00	1.719	0.341	19.99	94.50	500.00
24.02.2014	100	94.00	1.942	0.403	20.75	96.17	385.40
Total/Avg.	**800**	**92.18**	**1.919**	**0.404**	**21.39**	**82.44**	**419.25**

Race reared: Double Hybrid

h. Revenue Generation

A sum of **Rs. 1537117.00** was generated by Training Dvision from the sale of cocoons, course fee, accommodation charges, etc.

XII. PROGRAMMES BEING IMPLEMENTED IN COORDINATION WITH DOS OF DIFFERENT STATES (AT A GLANCE)

Sl. No.	Name of the Project/ Programme	Duration	States involved/ covered	See Page No.
1.	Pre-authorisation field trials of L14 x CSR2: A new Polyvoltine x Bivoltine hybrid of silkworm *Bombyx mori* L. with superior fibre qualities	Apr. 2012-Mar.2014	Karnataka, Andhra Pradesh, Tamil Nadu, Maharashtra and Madhya Pradesh	74
2.	All India Co-ordinated Experiment on Mulberry (AICEM) Phase-III	Aug. 2011-Dec. 2015	Karnataka, Andhra Pradesh, Tamil Nadu	79
3.	Popularization of authorized silkworm hybrids among the farmers of south India	Nov. 2012-Oct. 2014	Karnataka, Andhra Pradesh, Tamil Nadu, Maharashtra and Madhya Pradesh	80
4.	Cluster Promotion Programme	April 2013 to March 2017	Karnataka, Andhra Pradesh, Tamil Nadu, Maharashtra and Madhya Pradesh	84
5.	Technology demonstrations – Integrated nutrient management, Integrated pest management, composting & vermi-composting, mulberry tree plantation, Efficacy of Poshan and Navinya, Intercropping in mulberry	Continuous	Karnataka, Andhra Pradesh, Tamil Nadu, Maharashtra and Madhya Pradesh	88

XIII. राजभाषा कार्यान्वयन संबंधी गतिविधियाँ

केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, मैसूर में वर्ष 2013-14 के दौरान राजभाषा नीति का पूरा अनुपालन किया गया । राजभाषा अधिनियम की धारा-3(3) का शत प्रतिशत अनुपालन सुनिश्चित किया गया है । संस्थान में राजभाषा कार्यान्वयन समिति की बैठक का आयोजन कर राजभाषा प्रगति के बारे में समय-समय पर समीक्षा की गई । हिन्दी कार्यशाला का आयोजन, हिन्दी दिवस/पखवाडे का आयोजन, हिन्दी में तकनीकी पुस्तकों और हिन्दी पत्रिका का प्रकाशन तथा प्रोत्साहन योजना का कार्यान्वयन किया गया है ।

वर्ष के दौरान यथा सितंबर 2013 में संस्थान को 2011-12 के दौरान संघ की राजभाषा नीति के कार्यान्वयन में उत्कृष्ट निष्पादन के लिए केंद्रीय रेशम बोर्ड की राजभाषा चलशील्ड योजना के अंतर्गत प्रशस्ति पत्र प्राप्त हुआ है । संस्थान द्वारा उक्त अवधि के दौरान राजभाषा कार्यान्वयन की विभिन्न बिन्दुओं पर की गई कार्रवाई का विवरण निम्नानुसार है ।

1. धारा 3(3) का अनुपालन: राजभाषा अधिनियम 1963 की धारा 3(3) के अधीन आने वाले सभी कागज़ात द्विभाषी में जारी किए गए ।

2. नियम 11 का अनुपालन: सभी फार्म, पत्रशीर्ष, रबड़ मोहरें, सूचना पट्ट, नामपट्ट, लिफाफे, पहचान-पत्र , परिचय-पत्र आदि द्विभाषी हैं इन्हें सुनिश्चित करने हेतु जाँचबिंदु (फोटोप्रति कक्ष, भंडार अनुभाग, प्रेषण कक्ष और संबंधित अधिकारी के यहाँ) बनाए रखे गए हैं ।

3. हिन्दी पत्राचार: वर्ष के दौरान क, ख तथा ग क्षेत्र स्थित केंद्रीय सरकारी कार्यालयों को क्रमश: 92.5%, 69.7% और 64.7% तथा क व ख क्षेत्र स्थित राज्य सरकार के कार्यालयों/व्यक्तियों को क्रमश: 99.5% तथा 96.9% पत्र हिन्दी में भेज कर पत्राचार लक्ष्य से अधिक प्रतिशत प्राप्त किया है।

4. राजभाषा कार्यान्वयन समिति की बैठकों का आयोजन: संस्थान में राजभाषा कार्यान्वयन समिति की बैठक का आयोजन कर राजभाषा प्रगति के बारे में समय-समय पर यथा प्रत्येक तिमाही के दौरान विभागीय राजभाषा कार्यान्वयन समिति की बैठकों का आयोजन कर समीक्षा की गई । वर्ष 2013-14 के अंतर्गत राजभाषा कार्यान्वयन समिति की बैठकों का क्रमश: दिनांक 17-06-2013, 06.09.2013, 31.12.2013 एवं 17.03.2014 को आयोजन किया गया तथा बैठकों में लिए गए निर्णयों पर अनुवर्ती कार्रवाई की गई।

5. हिन्दी कार्यशालाओं का आयोजन: संस्थान के पदधारियों को सरकारी काम-काज में हिन्दी का प्रयोग करने और साथ-साथ राजभाषा नीति की जानकारी देने के लिए प्रत्येक तिमाही में हिन्दी कार्यशाला का आयोजन किया गया । तकनीकी तथा प्रशासनिक पदधारियों के साथ-साथ अधिकारियों एवं वैज्ञानिकों के लिए भी इस वर्ष के दौरान क्रमश: दिनांक 20.6.2013, 28.09.2013, 28.12.2013 तथा 14.3.2014 को अलग-अलग एक दिवसीय हिन्दी कार्यशाला का आयोजन कर कुल 30 अधिकारी व 27 कर्मचारियों को प्रशिक्षित किया गया ।

6. हिन्दी टिप्पण-आलेखन प्रोत्साहन योजना का कार्यान्वयन: संस्थान एवं इसके अधीनस्थ केंद्रों में कार्यरत अधिकारियों तथा कर्मचारियों को हिन्दी में मूल रूप से काम करने को प्रोत्साहित करने के लिए केंद्रीय रेशम बोर्ड की उदारीकृत टिप्पण-आलेखन प्रोत्साहन योजना लागू की गई है जिसके अंतर्गत निर्धारित शब्द लिखने पर नकद पुरस्कार दिया जाता है । इस वर्ष के दौरान इस योजना के अंतर्गत संस्थान के 4 पदधारियों को दिनांक 16.9.2013 को आयोजित राजभाषा पखवाडा समापन समारोह में नकद पुरस्कार वितरित किए गए, उनके अलावा अधीनस्थ कार्यालयों के 11 पदधारियों को भी इस योजना के अंतर्गत पुरस्कार प्राप्त हुआ है ।

7. वैज्ञानिक क्षेत्र में हिन्दी का प्रयोग: वर्ष के दौरान कुछ वैज्ञानिकों ने शोध-पत्र और लेख मूल रूप से हिंदी में तैयार किया और इन्हें कें रे अ प्र सं, मैसूर की अर्धवार्षिक राजभाषा पत्रिका रेशम किरण में भी प्रकाशित किया गया ।

8. हिन्दी पुस्तक/पुस्तिकाओं का प्रकाशन: संस्थान की वार्षिक रिपोर्ट और प्रशिक्षण कैलेंडर द्विभाषी में प्रकाशित किए गए । संस्थान की गृह पत्रिका "रेशम किरण" (अर्ध वार्षिक) के 2 अंकों का प्रकाशन किया गया।

9. राजभाषा नियम 10(4) के अंतर्गत अधीनस्थ कार्यालयों को अधिसूचित किया जाना: जिन कार्यालयों में हिन्दी में कार्यसाधक ज्ञान रखने वालों का प्रतिशत 80 हो जाता है उन कार्यालयों को मंत्रालय द्वारा राजभाषा नियम 10(4) के अधीन अधिसूचित किया जाता है । इस संस्थान के अलावा 06 अधीनस्थ कार्यालयों को अधिसूचित कराया जा चुका है ।

10. हिन्दी प्रतियोगिताओं का आयोजन: संस्थान में दिनांक 2.9.2013 से 16.9.2013 तक राजभाषा पखवाड़ा मनाया गया जिस दौरान 10 विभिन्न हिन्दी प्रतियोगिताओं यथा 1.सहीलेखन, 2.श्रुतलेखन 3. स्मृति परीक्षण 4. सामूहिक चर्चा 5.वाक् प्रतियोगिता 6. टिप्पण-आलेखन एवं प्रशासनिक शब्दावली 7. तकनीकी शब्दावली 8. गीत 9. तस्वीर क्या बोलती है ? 10. अंत्याक्षरी प्रतियोगिताओं का आयोजन किया गया । प्रत्येक प्रतियोगिता के विजेताओं को प्रथम, द्वितीय, तृतीय एवं सांत्वना पुरस्कार नकद रूप में दिया गया ।

11. कंप्यूटर पर हिन्दी में कार्य: धारा 3(3) का अनुपालन, फार्म/प्रपत्र, मानक मसौदे, तिमाही रिपोर्ट तथा मूल्यांकन रिपोर्ट, बैठकों की कार्रवाई संबंधी कार्य कंप्यूटर पर सुचारु रूप से किया जा रहा है। संस्थान में प्राय: सभी अभिकलित्रों में यूनिकोड की व्यवस्था है जिससे हिन्दी, अंग्रेजी तथा अन्य भारतीय भाषाओं में काम करने में सुविधा हुई है ।

12. पुरस्कार: इस वर्ष के दौरान यथा सितंबर 2013 में केंद्रीय रेशम बोर्ड की राजभाषा चलशील्ड योजना के अंतर्गत संस्थान को वर्ष 2011-12 के दौरान संघ की राजभाषा नीति के कार्यान्वयन में उत्कृष्ट निष्पादन के लिए केंद्रीय रेशम बोर्ड से प्रशस्ति पत्र प्राप्त हुआ ।

इसके अलावा संस्थान के अधीनस्थ कार्यालय उप रेशमकीट प्रजनन केंद्र, कूनूर को वर्ष 2012-13 के दौरान राजभाषा नीति के कार्यान्वयन में उत्कृष्ट कार्य निष्पादन के लिए नगर राजभाषा कार्यान्वयन समिति, ऊटी-कूनूर द्वारा संचालित चलशील्ड योजना में प्रथम पुरस्कार प्राप्त हुआ ।

13. राजभाषा नीति के कार्यान्वयन में प्राप्त उपलब्धियों और राजभाषा कार्यान्वयन कार्यकलापों को दर्शाने वाले पाँच चार्ट हिन्दी में तैयार किए गए ।

XIII. ACTIVITIES REGARDING OFFICIAL LANGUAGE IMPLEMENTATION

During 2013-14 Official Language policy has been implemented well at Central Sericultural Research and Training Institute, Mysore. Compliance of section 3(3) of the Official Languages Act has been ensured. The progress in implementation of Hindi was reviewed from time to time by conducting meetings of the Official Language implementation committee.

Organisation of Hindi workshops, Hindi day, Hindi fortnight, publication of technical books in Hindi, publication of Hindi magazine have been done and Hindi noting-drafting incentive scheme has been implemented.

During this year i.e. in September 2013 the Institute received citation under Official Language rolling shield scheme of CSB for the excellent performance made in implementation of the Official Language during the year 2011-12. Action taken on various items of official language implementation during the period is as follows:

1. Compliance of section 3(3) : The papers coming under section 3(3) of Official Languages Act 1963 have been issued in bilingual.

2. Compliance of Rule 11 : All types of forms, letter heads, Rubber stamps, Notice boards, Envelopes, Identity cards, etc are in bilingual. Check points (at Xerox cell, Stores section, Despatch section and the concerned officer) have been devised to ensure the same.

3. Hindi Correspondence : During the year the percentage of letters sent in Hindi to different regions were more than the prescribed targets i.e. 92.5%, 69.7% and 64.7% letters were sent in Hindi to Central Govt. Offices of A, B and C regions respectively and 99.5% and 96.9% letters in Hindi to State Govt Offices and individuals of A & B regions.

4. Organisation of meetings of the Official Language Implementation Committee : The progress of implementation of the Official Language has been reviewed from time to time by conducting OLIC meeting in every quarter. During the year 2013-14 Official Language Implementation Committee meetings were organised on 17.06.2013, 06.09.2013, 31.12.2013 and 17.03.2014 and follow up action was taken on the decisions of the meeting.

5. Organisation of Hindi Workshops : Hindi workshop was organised in each quarter for the officials of the Institute to provide information as to use of Hindi in the official work and the information of Official Language Policy. During the year, 30 officers and 27 staff have been trained in Hindi workshops organised on 20.06.2013, 28.09.2013, 28.12.2013 and 14.03.2014 separately for technical and administrative officials, officers and scientists.

6. Implementation of noting-drafting incentive scheme : To encourage the officers and staff of this institute and its subordinate offices to do their work originally in Hindi, CSB's liberalised noting-drafting incentive scheme was implemented in which cash awards are given for writing prescribed words in Hindi. During the year cash awards were given to 4 officials on the valedictory function of Official Language fortnight held on 16.09.2013. Apart from this 11 officials of subordinate offices were also awarded prizes under this scheme.

7. Use of Hindi in Scientific field : During the year some of the scientists prepared research papers and articles originally in Hindi and also they were published in Resham Kiran, half yearly magazine in Hindi brought out by CSRTI, Mysore.

8. Publication of Hindi book/booklets : Annual report of the Institute and the training calender were published in bilingual. Two issues of 'Resham Kiran' (Half yearly house journal) of this institute were also published.

9. Notification of the subordinate offices under 10(4) of the Official Languages rules : The offices in which 80% of the staff are having working knowledge in Hindi, are notified under 10(4) of the official languages rules. Apart from this office, 6 subordinate offices have also been notified.

10. Organisation of Hindi competitions : Official Language fortnight was organised from 02.09.2013 to 16.09.2013 during which 10 different Hindi competitions viz. 1. Correct writing 2. Dictation, 3. Memory test, 4. Group discussion, 5. Elocution, 6. Noting-drafting and administrative glossary, 7. technical glossary, 8. songs, 9.what does the picture speak? and 10. Antyakshari competitions were organised. The winners of the competitions were awarded with first, second, third and consolation prizes.

11. Work on computers in Hindi : Compliance of section 3(3), forms, standard drafts, quarterly progress report and evaluation report, work related to meetings carried out smoothly on computers. Unicode system is activated in all computers which facilitates to do work in Hindi, English and other Indian language.

12. Awards : During the year i.e in September 2013 the institute was awarded with a citation under the Official Language Rolling shield scheme of CSB for the excellent performance made in the implementation of official language policy of the union for the year 2011-12.

Apart from this SSBS, Coonoor, a subordinate office of the institute was awarded first prize under the Rolling Shield Scheme of the Town Official Language Implementation Committee Ooty-Coonoor for excellent performance made in Official Language Policy during 2012-13.

13. Five Charts were prepared in Hindi showing details of the achievements made in implementation of Official Language Policy and activities of the implementation of the Official Language.

XIV. ADMINISTRATIVE REPORTS

Central Sericultural Research & Training Institute, Mysore, Karnataka and its nested units

Regional Sericultural Research Stations (RSRS)
1. Kodathi, Karnataka
2. Chamarajanagara, Karnataka
3. Anantapur, Andhra Pradesh
4. Salem, Tamil Nadu

Research Extension Centres (REC)	
1. Bidaraguppe	10. Gobichettypalayam
2. Chitradurga	11. Krishnagiri
3. Madivala	12. Samayanallur
4. Eluru	13. Udumalpet
5. Kalyandurgam	14. Palakkad
6. Madakasira	15. Amaravati
7. Raychoti	16. Baramati
8. Venkatagirikota	17. Parbhani
9. Vikarabad	18. Hoshangabad
	19. Srivilliputhur

Sub-units of Research Extension Centre (REC-SU)	
1. Kanakapura	15. Suryapet
2. Koppal	16. Chebrolu
3. Kinakahalli	17. Atmakur
4. Penukonda	18. Metpally
5. Bidar	19. Tumkur
6. Vaniyambadi	20. Ranebennur
7. Kalpetta	21. Bellary
8. Aurangabad	22. Shahapur
9. Maddur	23. Shirahatti
10. Shivamogga	24. Bijapur
11. Jalna	25. Jamkhandi
12. Osmanabad	26. Avinashi
13. Burhanpur	27. Trichy
14. Giddalur	28. Berigai

Cluster Promotion Centre (CPC) - 1. Hindupur

Cluster Development Centre (CDC) - 1. Palamaner 2. Y N Hoskote

P4 Basic Seed Farm - 1. Hassan

Satellite Silkworm Breeding Station - 1. Coonoor

BIVOLTINE PROMOTION CLUSTERS UNDER CSRTI, MYSORE

#	Place
	KARNATAKA
1	Gouribidnur
2	Soraba
3	Andaralahalli
4	Bidarakote
5	Siddlaghatta
6	Gajanur
7	Raugodlu
8	B.R.Koppalu
9	Y.N.Hoskote
10	Thoreshettihalli
11	Tumkur
12	Bijapur
13	Channarayapatna
14	Aurad
15	Tubagere
16	Humnabad
17	Shapur (Kolar dist)
18	Gulbarga
19	Ithandahalli
20	Yelburga
21	Yeldur
22	Kanakapura
23	Shirahatti
24	Bevuru
25	Harohalli
26	Ranebennur
27	Belgaum
28	Kurudamalai
29	Jamakhandi
30	Doddalahalli
31	T.Narasipura
32	Challakere
33	H.D.Kote
34	Hiriyur
35	K..R.Nagar
36	Davangere
37	Belgaum
38	Bannikuppe
39	Haveri
40	D.Halasahalli
41	Sira
42	H. B. Halli
43	Kudligi
44	Lingasgur
45	Tekal
46	Shahapur
	TAMIL NADU
47	Udumalpet
48	Kumaralingam*
49	Madathukulam
50	Gudimangalam
51	Poolavadi
52	Pollachi
53	Alangkayam
54	Oddanchatram
55	Sannarpatti
56	Annur
57	Uttangarai
58	Kottur
59	Palani
60	Bhavani
61	Anthiyur
62	P. Palayam
63	Gobi South
64	Dharapuram
65	Manurpalayam
66	Pongalur
67	Dharmapuri
68	Berigai
69	A. Pattinam
70	Srivilliputhur
71	Bagalur
72	Kodiyalam
73	Keeranur
74	Alangudi
	KERALA
75	Kozhikode
76	Palakkad
	ANDHRA PRADESH
77	Giddalur
78	Madakasira
79	Pattikonda
80	Atmakur
81	Suryapet
82	Bhongir
83	Zaherabad
84	Mettapalli
85	Bhimadole
86	Kalyanadurga
87	V.Kota
88	Palamaner
89	Penukonda
90	Chebrole
91	Vijayawada
92	Chittoor
93	Hindupur
	MAHARASHTRA
94	Nanded
95	Osmanabad
96	Sangli
97	Satara
98	Jalna
99	Beed
100	Akola
101	Wardha
102	Buldhana
	MADHYAPRADESH
103	Burhanpur
104	Khandwa
105	Betul
106	Hoshangabad

RETIREMENT/RESIGNATION/EXPIRY OF PERSONNEL DURING THE YEAR

The following are the names and designations of personnel who retired or resigned, whose contributions to the growth and development of the industry are sincerely acknowledged.

Name	Designation	Date
I. Retired		
1. Dr. P. G. Joge	Scientist D	April, 2013
2. Dr. M. A. Shekhar	Scientist D	April, 2013
3. Sri. Basavaraju	STA	April, 2013
4. Sri. Nagendra	Asst. Technician	May, 2013
5. Sri. Hiriyanna	AD (A&A)	May, 2013
6. Sri. G. A. Shankar	TA	May, 2013
7. Sri. H. Krishnaiah	STA	June, 2013
8. Dr. R. Balakrishna	Scientist D	June, 2013
9. Sri.Chikkachamaiah	Safaiwala	June, 2013
10. Sri. P. Prakash	Attender	August, 2013
11. Dr. Tomy Philip	Scientist C	October, 2013
12. Sri. Christopher James	Staff Car Driver	November, 2013
13. Sri. R. N. Parate	Asst.Director	December, 2013
14. Sri. Keshavacharyulu	Scientist C	December, 2013
15. Dr. D. D. Sharma	Scientist C	January, 2014
16. Smt. K. J. Rosamma	Supdt. (Admn)	March, 2014
17. Sri. K. R. Venkatesha Murthy	STA (S/G)	March, 2014
18. Smt. B. C. Vasantha	TA	March, 2014
19. Sri. S. K. Basavaraju	TA	March, 2014
20. Sri. Mariswamy	TA	March, 2014
II. Resigned		
1. Sri. A. H. Neve	DD (A&A)	June, 2013
2. Dr. S. Lakshmanan	A.D (Stat)	August, 2013
3. Sri. Bore Gowda,	Asst. Technician	September, 2013
4. Sri. N. D. Javare Gowda	Asst. Technician	December, 2013
5. Sri. M. K. Nagesha Rao	TA	October, 2013

One colleague passed away during the year and his contribution to the growth and development of sericulture is gratefully acknowledged.

1. Sri. T. V. Mahadevappa	TA	December, 2013

Budget (Rs. In lakhs):

Sl. No.	Paticulars	Granst Released for 2013-14	Expenditure 2013-14
1	Non-Plan	3869.23	3869.23
2	Plan-Gen-31	624.75	624.75
3	Plan-Cap-35	151.43	151.43
	Toal	**4645.41**	**4645.41**

R & D & ADMINISTRATIVE PERSONNEL OF CSR&TI AND IT'S NESTED UNITS

I. R & D Personnel

A. CSR&TI, Mysore

Dr. B. B. Bindroo DIRECTOR

Planning, monitoring, co-ordination & evaluation

Dr. S. K. Ashwath, Sci-D

Dr. Vineet Kumar, Sci-D

Sri. H. M. Munikrishnappa, Sci-C

Smt. M. Rekha, A.D. (Stat)

Silkworm Crop Improvement [Sericulture Division]

Dr. A. Naseema Begum, Sci-D

Dr. V. Premalatha, Sci-D

Dr. Virendra Kumar, Sci-D

Dr. M. Munirathnam Reddy, Sci-D

Dr. N. Mal Reddy, Sci-D

Dr. K. K. Sharmila, Sci-D

Dr. Dayananda, Sci-D

Dr. S. Manthira Moorthy, Sci-D

Silkworm Crop Production [RTI-I & II, TVDC, Grainage

Dr. S. Somaprakash, Sci-D

Dr. R. Bhagya, Sci-D

Sri. S. Purushotham, Sci-C

Dr. P. C. Santha, Sci-C

Sri. S. B. Kulkarni, Sci-C

Silkworm Crop Protection [Silkworm Pathology, PML]

Dr. M. Balavenkatasubbaiah, Sci-D

Dr. Vinod Kumar, Sci-D

Smt. A. V. Mary Josepha, Sci-D

Sri. J. B., Narendra Kumar, Sci-D

Sri. A. R. Narasimha Nayak, Sci-C

Host Plant Division

[MBG, Molecular Biology-1 Tissue Culture, Mulberry Physiology, Agronomy]

Dr. T. Thippeswamy, Sci-D

Dr. M. K. Prithviraje Urs, Sci- D

Sri. K. Rajashekar, Sci-D

Dr. M. G.Sabitha, Sci-D

Dr. V. Girish Naik, Sci-D

Sri. Gandhi Doss, Sci-C

Host Plant Production [Farm Management, SS&C]

Dr. Dasappa, Sci-D

Dr. V. Gunashekar, Sci-C

Sri. B. T.Srinivasa, Sci-D

Sri. J. P. Renukeshwarappa, Sci-C

Sri. Sibayan Sen, Sci-C

Sri. Vinod Kumar Yadav, Sci-B

Host Plant Protection [Mulberry Pathology]

Dr. V. Nishitha Naik, Sci-D

Dr. P. M. Pratheesh Kumar, Sci-D

Extension Division

Dr. G .S. Vindhya, Sci-D

Dr. Kanika Trivedy, Sci-D

Sri. S. B. Nagaraja, Sci-D

Dr. B. Gangadhar, Sci.D.

Smt. A. S. Suma, Sci-C

Dr. G. S. Geetha, Sci-C

Smt. Mahima Santhi, Sci-C

Post-Cocoon evaluation unit [Reeling]

Dr. Y. C. Radhalakshmi, Sci-D

Sri. Kariappa, Sci-D

Sri. K. P. Shivakumar, Sci-C

Training Division

Dr. S. D. Sharma, Sci-D

Dr. V. N. Sudha, Sci-D

Sri. C. Parameshwara, Sci-C

Dr. S. N. Pallavi, Sci-C

Dr. R. S. Katiyar, Sci-C

Publicity & Publications

Sri. Mukund V. Kirsur, Sci-D

Sericultural Engineering Division

Dr. Satish Verma, Sci-E (Engineer)

Sri. Mohan Rao Jadhav, EE

B. Nested units of CSR&TI, Mysore

RSRS, KODATHI
Dr. K. L. Rajanna, Sci-D
Dr. Maheshwari, Sci-D
Dr. P. K. Ambika, Sci-D
Dr. P. Sudhakar, Sci-C
Mr. N. Shivashankar, Sci-C
Dr. P. Sudhakar Rao, Sci-C
Smt. K. L. Philomena, Sci-C
Sri. S.K. Hanumantharayappa, Sci-C

REC, Madivala
Dr. M. Noble Morrison, Sci-D

REC, Bidarguppe
Dr. V. Lakshmanan Sci-D

REC, Koppal
Sri. Y. N. Sanath Kumar, Sci-C

REC SU, Kanakapura
Dr. M. R. Subrahmanyam, Sci-D

REC, Chitradurga
Dr. M. T. Himantharaj, Sci-D
Sri. A. Umesha, Sci-C

REC SU, Tumkur
Sri. Vedavyasa, Sci-C

REC SU, Ranibennur
Dr. M. K. Raghunath, Sci-C

REC SU, Kudlagi
Dr. Raveendra M. Mattigatti, Sci-C

REC Sub-unit, Bellary
Sri. M. Nagaraju, TA

REC SU, Shahapur
Sri. B. M. Krishnappa, TA

REC SU, Shirahatti
Sri. Anis Ahmed Shariff, TA

REC SU, Bijapur
Sri. Shreeshail Bheewa Arjune, TA

REC SU, Jamkhandi
Sri. G. M. Ravikumar, TA

CDC, Y. N.Hosekote
Sri. G. Papaiah, TA

RSRS, CHAMARAJANAGAR
Dr. B. Mallikarjuna, Sci-D
Dr. K. Srikanta Swamy, Sci-D
Dr. R. Meenal, Sci-C

REC SU Kinakanahalli
Sri. K. C. Mahalingappa, Sci-C

RSRS, SALEM
Dr. Chikkanna, Sci-D
Sri. S. Rajakumar, Sci-D
Dr. S. Radhakrishnan, Sci-D
Sri. R. Vijayakumar, Sci-C
Sri. C. A. Mary Flora, Sci-C
Dr. J. Ravikumar, Sci-C
Dr. S. Mahiba Helen, Sci-C

REC, Krishnagiri
Dr. S. Balasaraswathi, Sci-D
Dr. S. Masilamani, Sci-C

REC, Samayanallur
Sri. A. Gnanakumar Daniel, Sci-C
Sri. T. Sivasubramanian, Sci-C

REC, Gobichettypalayam
Sri. T. Thirunavukkarasu, Sci-D
Sri. A. Mani, Sci-D
Dr. N. Dhahira Beevi Sci-D

REC, Udumalpet
Smt. G. Punithavathy, Sci-D
Dr. P. Samuthiravelu, Sci-C
Dr. K. Chandrasekaran, Sci-C
Dr. C. M. Babu, Sci-C
Sri. R. Anbazhagan, Sci-C

REC, Palakkad
Smt. K. Sarala, Sci-C
Smt. M. Siamala, Sci-C

REC SU, Kalpetta
Smt. P. V. Soudaminy, Sci-C

REC SU, Vaniyambadi
Sri. O. K. Gopinath, Sci-C

REC SU, Trichy
Sri. N. G.Selvaraju, Sci-D

REC SU, Berigai
Sri. Y. Humayun Sherief, Sci-C

REC SU, Srivilliputhur
Sri. N. Sakthivel, Sci-D
Sri. B. Mohan, Sci-C

REC SU, Avinashi
Dr. A. Mohamed Babu, Sci-D
Sri. Issac Joseph, Sci-C

RSRS, ANANTAPUR
Sri. Ch.Satyanarayana Raju, Sci-D
Sri. C. Subramanya Reddy, Sci-D
Dr. N. Sivarami Reddy, Sci-D
Dr. M. Raghupathi, Sci-D
Sri. M. A. Shanthan Babu, Sci-C

REC SU, Suryapet
Dr. P. S. Reddy, Sci-C
REC, Atmakur
Dr. P. Venkataramana, Sci-D
REC, Vikarabad
Dr. B. Narasimha Murthy, Sci-D
REC SU, Penukonda
Dr. S. Vidyunmala, Sci-D
Dr. A. Venugopal, Sci-D
REC, Rayachoty
Dr. M. Venkatachalapathy, Sci-D
REC, Eluru
Dr. M. Venkateswara Rao, Sci-D
REC SU, Chebrolu
Sri. T. V. S. Srinivasa Rao Sci-D
REC, Madakasira
Dr. B. Kasi Reddy, Sci-D
REC, V. Kota
Dr. T. Mogili, Sci-D
CPC, Palamaner
Dr. G. V. Prasad, Sci-D
CPC, Hindupur
Dr. M. P. Reddy, Sci-D
REC SU, Bidar
Sri. Ishwar, Sci-C
REC, Kalyanadurgam
Sri. B. Vijaya Naidu, Sci-C
REC SU, Metpally
Sri. B. V. Sanjeeva Rao, Sci-C

REC SU, Giddalur
Dr. N. B. Chowdary, Sci-D
SSBS, Coonoor
Sri. R. Gururaj, Sci-D
Smt. E. Rajalakshmi, Sci-C
P4 BSF, Hassan
Dr. G. V. Kalpana, Sci-D
Dr. K. B. Chandrashekar, Sci-D
REC SU, Maddur
Dr. V. B. Mathur, Sci-D
REC, SU Shivamoga
Dr. H. Jayaram, Sci-D
REC, Parbhani
Sri. A. J. Karande Sci-D
REC, Baramati
Sri. Ram Prakash, Sci-C
REC SU, Aurangabad
Sri. Rahul Singh, Sci-C
REC, Amaravathi
Sri. R. V. Kushwaha, Sci-C
REC, Hoshangabad
Sri. R. K. Khare, Sci-C
REC SU, Jalna
Dr. Kailash Babu Rajput, Sci-C
REC SU, Osmanabad
Sri. A. P. Bagde, Sci-C
REC SU, Burhanpur
Sri. Pradeep Shukla, Sci-C

II. ADMINISTRATIVE PERSONNEL

Sri. A. Manoharan, DD (F)
Sri. R. Arasappa, DD (A&A)
Dr. B. Jayaramulu, DD (OL)
Sri. V. Ganesan, DD (C)
Sri. B. Y. Talawar, LIO
Sri. Yoganarasimha, AD (A&A)
Smt. V. Jayashree, AD (OL)
Sri. B. S. Pappu, AD (Pub)
Smt. Girijamma, AD (A&A)
Sri. Mohan, AD (A&A)

STAFF POSITION AS ON 31.03.2014

Category	Sanctioned	Filled	Vacant
Director	1	1	0
R & D	171	135	36
Technical	198	161	37
Administrative	175	152	23
Support	87	65	22
Total	**632**	**514**	**118**

XV. RESEARCH ADVISORY COMMITTEE

Chairman
Prof. K. Narayana Gowda
Vice Chancellor
University of Agricultural Sciences
GKVK, Bengaluru-560 065

Dr. Rajeev Varshney,
Principal Scientist & Director,
Centre of excellence in Genomics
ICRISAT, Patancheru,
Hyderabad 502 324, Andhra Pradesh

Prof. Maheshwaran,
Dept. of Genetics and Plant Breeding,
Tamil Nadu Agricultural University,
Coimbatore- 641 003
Tamil Nadu

Dr. R. R. Prasad,
Professor & Head,
Centre for Equity and Social Development,
National Institute for Rural Development,
Hyderabad-500 030, Andhra Pradesh

Dr. S. Vadivelu,
Former Principal Scientist &
Head, NBSS & LUP,
No. A-106, Nagarjuna Garden,
F-Block, Sahakar Nagar,
Bengaluru -560 092

Dr. Nagaraju,
Prof. & Head, Plant Virology,
Dept. of Plant Pathology,
University of Agricultural Sciences,
GKVK, Bengaluru -560 065

Dr. R. J. Rabindra
Dean, College of Post Graduate Studies,
Central Agriculture University
Umiam, Barapani - 793 103
Meghalaya

Dr. K.T. Sampath,
Former Director of NIANP,
FF 02, Passion Paradise,
45, I Main, I Block,
Thyagarajanagar, Bengaluru -560 030

Commissioner for Sericulture Dvpt. &
Director of Sericulture, Govt. of Karnataka,
5th Floor, M. S. Building
Dr. B. R. Ambedkar Veedhi
Bengaluru - 560 001, Karnataka

Commissioner of Sericulture
Govt. of Tamil Nadu, Post Box No.90
Foulke's Compound, Analmedu,
Salem- 636 001, Tamil Nadu

Commissioner of Sericulture
Govt. of Andhra Pradesh
Road No. 72, Prashasan Nagar
Jubilee Hills
Hyderabad – 500 033, Andhra Pradesh

Director of Sericulture,
Govt. of Maharashtra,
New Administrative Building,
No.2, B-Wing, Civil Lane, VI Floor,
Nagpur-440 010, Maharashtra

The Commissioner,
Commissionerate of Rural Development,
LMS Compound, Vikas Bhavan, P.O.,
Thiruvananthapuram-695 033, Kerala

The Commissioner,
Directorate of Sericulture,
Govt. of Madhya Pradesh,
Lower Basement, Satpura Bhavan
Bhopal-461 004

Director, Central Silk Board,
CSB Complex, BTM Layout,
Madivala, Bengaluru -560 068

The Director,
Central Silk Technological Research Institute,
Central Silk Board, BTM Layout,
Madivala, Bengaluru -560 068

The Director,
National Silkworm Seed Organization,
Central Silk Board, IV Floor, CSB Complex,
BTM Layout, Madivala,
Bengaluru -560 068

The Director,
Central Sericultural Germplasm Resources Centre,
Central Silk Board, P.B. No.44, Thally Road,
Hosur - 635 109, Tamil Nadu

The Director,
Seri-Bio-Tech. Research Laboratory,
CSB Campus, Sarjapur Road,
Carmelram Post, Kodathi,
Bengaluru -560 035.

The Director,
Karnataka State Sericulture Research &
Development Institute,
Thalaghattapura, Bengaluru - 560 062

The Director,
Andhra Pradesh State Sericulture Research &
Development Institute,
Kirikera, Hindupur-515 211,
Andhra Pradesh

The Director,
Karnataka State Sericulture Research &
Development Institute,
Thalaghattapura, Bengaluru - 560 062

The Director,
Andhra Pradesh State Sericulture Research &
Development Institute,
Kirikera, Hindupur-515 211,
Andhra Pradesh

Shri. Somashekar
S/o. Shri. Shivananjegowda,
Marigudi Beedhi, K. R. Pete Taluk,
Mandya District

Shri. R. Jagadeesh,
S/o Shri. D. Ravindranath,
388, Survey No.117, Gandhemadu Grama,
Elekere, Channapattana Taluk,
Ramanagar District-571 501, Karnataka

Sri. G. Gurumurthy Chetty
S/o. G. Appi Chetty
Dandapalli P.O.
Gangavaram mandal,
Chittoor Dist., Andhra Pradesh

Sri. D. Ahammed Sab
S/o. Sri. Dastigiri Sab
Silk reeler,
5-11-358, Rahammatpur,
Hindupur-515 201,
Anantapur Dist, Andhra Pradesh

Sri. N. R. Ramachandran,
S/o. Sri. Narayanaswamy
No. 29/A, Mukkathripalayam Street,
Anandapuram Village P.O. 605 201
Gingee Taluk, Vilupuram Dist.
Tamil Nadu

Sri. M. Ravi,
S/o. N. Muthuswamy
Karatur, Natamangalam P.O.,
Behind Divya theater,
Salem – 636 010
Tamil Nadu

Invitees

Officer Incharge,
Regional Sericultural Research Station
Central Silk Board,
Ministry of Textiles, Govt. of India,
P.B. No.50, Rapthadu, Anantapur-515 001
Andhra Pradesh

Officer Incharge,
Regional Sericultural Research Station
Central Silk Board,
Ministry of Textiles, Govt. of India,
Carmalram Post,
Kodathi, Bengaluru-560 035

Officer Incharge,
Regional Sericultural Research Station
Central Silk Board,
Ministry of Textiles, Govt. of India,
Near Railway Station, Nanjangud Road,
Chamarajanagara-643 101, Karnataka

Officer Incharge,
Regional Sericultural Research Station
Central Silk Board,
Ministry of Textiles, Govt. of India,
Veeranam Road, Allikuttai Post,
Vaikkalapattarai, Salem-636 003, Tamil Nadu

The Deputy Secretary (Insp.),
Regional Office of Central Silk Board,
Ministry of Textiles, Govt. of India,
No. 16, Mittal Chambers, Nariman Point,
Mumbai-400 021, Maharashtra

The Deputy Secretary (Tech.),
Regional Office of Central Silk Board,
Ministry of Textiles, Govt. of India, Prasashan
Nagar, Road No.72, Jubilee Hills,
Hyderabad-500 096, Andhra Pradesh

The Deputy Secretary (Tech.),
Regional Office of Central Silk Board,
Ministry of Textiles, Govt. of India,
No.28/22, K.K. Salai, Kaveri,
Rangan Nagar, Saligramam,
Chennai- 600 093, Tamil Nadu

Dr. B. Bindroo, Director
Member-Convener,
Central Sericultural Research and Training Institute,
Srirampura, Manandavadi Road,
Mysore-570 008, Karnataka

XVI. REGIONAL RESEARCH ADVISORY COMMITTEES

RSRS, ANANTAPUR

Chairman
Dr. R. Sudhakara Rao, Director of Research, ANGRAU, Hyderabad.

Dr. P. Punna Rao,
Deputy Director of Extension,
ANGRAU, Hyderabad

Prof. D. Bharathi,
Professor, Dept. of Sericulture,
SPMVV, TIRUPATI.

Dr.B.Ravindranath Reddy,
Principal Scientist & Head, (Dry Land Agriculture)
Agriculture Research Station,
Kamalanagar,
ANANTAPUR - 515 001

Deputy Secretary (Tech.),
Regional Office,
Central Silk Board, HYDERABAD.

Sri P. Sadasiva Reddy,
Agrampalli,
Madakasira Mandal,
ANANTAPUR District.

Sri Ch. Satyanarayana Raju, Scientist – D,
Member- Convener
RSRS, ANANTAPUR.

Sri Peddi Ravinder, ,
RA Silks, ARM,
JANAGAON, Warangal District.

Dr. S. K. Krishna Murthy
Programme Coordinator,
KALYANADURGAM.

Sri B. Chandrasekhar,
Additional Director of Sericulture, Department of sericulture, Govt. of A.P.
HYDERABAD.

RSRS, SALEM

Chairman
Dr. S. V. Krishnamoorthy,
Prof & Head, Dept. of Sericulture,
TNAU, Coimbatore.

Dr. N. Raghupathy,
Prof.Head, Dept. Of Plant Pathology,
TNAU, Coimbatore

Dr. Ravikumar Theodore,
Prof.& Head, Dept. Of Agricultural Extension & Sociology,
TNAU, Coimbatore

Dr. K. Ramamoorthi
Professor,
TNAU, Coimbatore

Sri. P. Venugopal
Deputy Director,
DOS, Salem

Sri. D. Kirubagaran, ,
Deputy Secretary(Tech),
RO, CSB, Chennai

Sri. R. Ramakrishnan,
Farmer Member,
Udumalpet

Sri. C. M. Ramesh,
Reeler Member,
Dharmapuri

Dr. Chikkanna, Scientist-D
Member- Convener
RSRS,Salem, Tamil Nadu

RSRS, KODATHI AND RSRS CHAMARAJANAGARA

Chairman
Dr. R. Siddaramappa,
Professor of Soil Science and Agri. Chemistry (Retd),
UAS, Bangalore

Dr. K. C. Narayanaswamy,
Professor of Sericulture, UAS, Bangalore

Dr. M .S. Nataraju,
Prof., Department of Agri. Extn, UAS, Bangalore

Sri. B. K. Sandeep,
Tagachaguppe village, Kengeri Hobli, Bangalore

Joint Director of Sericulture
Bangalore division, Department of Sericulture
No.16, Reshme Bhavan, Okalipuram Bangalore

Dr. H. S. Shivaramu, Associate Professor, Department of Agronomy, UAS, Bangalore

Dr. H. R. Prabhakar, Joint Director,
DOS, Okalipuram, Bangalore

Sri. C. R. Jagadish, No.2090,Sri Ranga,11th Cross Kuvempunagar, Channapatana Ramanagar District

Dr. K. L Rajanna, Scientist-D, Member-Convener
RSRS, Kodathi, - 05.07.2013

Dr. Mallikarjuna, B. Scientist-D, Member-Convener
RSRS,Chamarajanagar - 03.12.2013

Details of Review meeting held during the year

#	Meeting	Date
1	Research Council (RC)	20th – 21st May 2013 25th - 26th November 2013
2	Research Advisory Committee (RAC)	19th - 20th July 2013 28th February 2013
3	Regional Research Advisory Committee (RRAC)	06.07.2013 at Anantapur 05.07.2013 at Kodathi 03.12.2013 at Chamarajanagara 04.12.2013 at Salem, Tamil Nadu

XVII. TRAINING ATTENDED

Institute/Place	Subject
Central Sericultural Research & Training Instute, Mysore	Training on Cluster Facilitators (22.5.2013 to 24.5.2013) **Participant:** B. Gangadhar
Central Sericultural Research & Training Instute, Mysore	Training programme on extension Management Approaches for promotion of sericulture industry, National Institute of Agricultural Extension Management, Hyderabad (29.07.2013 to 01.08.2013) **Participant:** Dasappa, B. Gangadhar
Department of Science and Technology, Govt. of India, From 21-25 October, 2013, Organised by ICFRE, Dehradun	Climate Change and Carbon Mitigation (21.10.2013 to 25.10.2013) **Participant:** M. G. Sabitha, A. K. Ambika
Central Sericultural Research & Training Instute, Mysore	Extension Management Approaches for Promotion of Sericulture Industry (29.07.2013 to 01.08.2013) **Participant:** D. S. Somaprakash
Central Sericultural Research & Training Instute, Mysore	ISO training on implementation of quality system as per ISO 9001:2008 (18.12.2013) **Participants:** Satish verma, Vindhya, G. S, Kanika trivedy , M. Balavenkata Subbaiah, Ashwath, S. K., Surendra Dutta Sharma, Virendra Kumar, Vinod kumar, Munirathnam Reddy, M, Malreddy, N.,Gangadhar, B., Sabita, M. G., Sharmila, K. K., Nishitha naik, V., Mary josepha (shery), A. V., Narendra kumar, J. B., Pratheesh kumar, P. M., Bhagya, R., Dayananda, Manthira Moorthy, S., Radhalakshmi, Y. C., Parameshwara, C., Santha, P. C. , Satish B. Kulkarni, Gandhi Doss, S., Vinod Kumar Yadav, R. S.Katiyar, B. Jayaramulu, A.Mahoharan, Girijamma, S. Yoganarasimha, V. Jayashree, M. R. Jadhav and Mohan.

XVIII. PARTICIPATION OF SCIENTISTS IN SYMPOSIA/SEMINAR/WORKSHOP/ CONFERENCES

International

#	Symposium/Seminar/ Workshop/Conference
1	6th BACSA International Conference "Building Value Chains in Sericulture" "BISERICA" 2013 held at Padua, Italy (07.04.2013 to 12.04.2013) **Paricipants:** S. Manthira Moorthy
2	XII International Conference on Vector & vector borne diseases at Mohanlal Sukhadia University, Udaipur, Rajasthan(16.09.2013 to 18.09.2013) **Participants:** Vinod Kumar
3	International Conference on Food technology, impact on nutrition and health IICFIN 2013), JNU, New Delhi (23.12.2013 to 24.12.2013) **Participants:** S. Rajakumar
4	International conference on bio-diversity, bioresources and biotechnology, Myosre (30.01.2014 to 31.01. 2014) **Participants:** Chikkanna, S. Balasaraswathi, J. Ravi Kumar

Overseas visit

Dr. Bindroo, Director, visited Bucharest, Romania from 20th to 22nd June, 2013 as one of the six member delegation group from India, headed by Secretary, Ministry of Textiles, Govt. of India to attend India - Romania Joint Working Group Meeting (JWG) on Textiles. Romanian side agenda included revamping the textile silk industry sector of Romania, investment for primary manufacturing, investment in clusters, new and innovative products and access of Indian companies to Romanian market. The Indian side agenda included India-Romania Textile sector trade, collaboration in Research and Development between the Central Silk Board and Romanian Institutes, collaboration in skill development and compliance, setting up of Textiles Trade Shows and investment in clusters. A concept note on collaboration between India and Romania in the field of R & D in sericulture was presented and discussed.

National

#	Symposium/Seminar/ Workshop/Converence
1	Impact Assessment of schemes and projects of central and state governments at ATI, Mysore(19.08.2013 to 21.08.2013) **Paricipants:** Kannika Trivedi, K. Rajashekar, Vineet Kumar, A. S.Suma
2	Workshop on Bivoltine silk reeling in Kollegal cluster, organised by CSTRI, Bangalore & DOS, Karnataka at silk exchange, Kollegal (29.08.2013) **Paricipants:** Y. C. Radhalakshmi, Kariyappa, K. P. Shivakumar
3	Hindi workshop organized at CSRTI, Mysore. (28.09.2013) **Paricipants:** J. B. Narendra Kumar, V. Girish Naik, K. K. Sharmila, V. Nishita Naik, P.C. Shantha, J. P. Renukeshwarappa, C. Parameshwara, S. B. Kulkarni, Sibayen Sen, Gandhi Doss, Vinod Kumar Yadav
4	National Conference on Status and conservation of Biodiversity in India with special reference to Himalaya 04.10.2013 to 05.10.2013) **Participants:** V. Girish Naik, S. Gandhi Doss
5	National Conference on recent advances in modern biology and sericulture for women empowerment and rural development at KSSDRI, Thalaghattapura, Bangalore (24.10.2013 to 26.10.2013) **Paricipants:** B. B. Bindroo, Satish Verma, J. B. Narendra Kumar, S. M. Moorthy, V. Girish Naik, R. Sumathy, V. Nishitha Naik, Thippeswamy T, K. K. Sharmila, Dayananda, S. Rajakumar, G. V. Kalpana, J. Mahesha, S. Gandhi Doss
6	Krishi Mela organized by DOS Karnataka (13.11.2013) **Paricipant:** Dasappa
7	Workshop on Bioinformatics and its application conducted by Bioinformatics Centre, CSRTI, Mysore (19.11. 2013 to 20.11.2013) **Paricipants:** Y. C. Radhalakshmi, G.V. Kalpana, A. Mahima Shanthi, S. Gandhi Doss,
8	Natioanl symposium on Recent advances in beneficial insects. IINRG, Ranchi (27.11.2013 to 29.11.2013) **Participants:** B. B. Bindroo, K. Srikantaswamy

9	XXIII conference of ISC , Bengaluru (04.12.2013 to 09.12.2013) **Participants:** A. M. Babu
10	Hindi Seminar at New Delhi (05.12.2013 to 07.12. 2013) **Participants:** Kanika Trivedy
11	Role of CRCs in bivoltine silk production at CSRTI, Mysore (13.12.2013) **Paricipants:** G. S. Vindhya, S. B. Nagaraj, B. Gangadhar A. S. Suma, G. S. Geetha, A. Mahima shanthi, S. Somaprakash, S. D. Sharma, C. Parameswara, R. S. Katiyar, S. N. Pallavi, S. D. Sharma, C. Parameswara and R. Bhagya
12	39th All India Sociology conference, UOM, Mysore (27.12.2013 to 29.12.2013). **Participants:** G. S. Geetha
13	Farmers Meet at Wheat Research Station, ICAR, Wellington (31.12.2013) **Paricipant:** Gururaj
14	National symposium on Innovations in science and technology for inclusive development, Mysore (January 03.01.2014 to 04.01.2014) **Participants:** Mary Josepha A. V., B. Ganagadhar
15	National seminar on Development and social issues, Periyar University, Salem (23.01.2014 to 24.01.2014) **Participants:** S. Rajakumar
16	Sericulture Farmer's Workshop at CSRTI, Mysore (28.01.2014) **Paricipants:** G. S. Vindhya, S. B. Nagaraj, B. Gangadhar A. S. Suma, G. S. Geetha, A. Mahima shanthi, Dasappa, Vinod Kumar Yadav
17	National conference on Sericulture for livelihood security, UAS Chintamani, Karnataka (29.01.2014 to 31.01.2014) **Participants:** B. Ganagadhara, Y.C. Radhalakshmi, K.B.Chandra Shekar, G. V. Kalpana, M. Venkatachalapathy, A. Venugopal, S. Rajakumar, M. N. Morison, N. Sakthivel
18	101st Indian Science Congress Association (ISCA) at University of Jammu, Jammu (J&K) (03.02.2014 to 07.02.2014) **Paricipant:** Vinod Kumar Yadav
19	National conference of Biodiversity and ecological Sustainability, Puri (February 15.02.2014 to 16.02.2014) **Participants:** A.M. Babu, J. Justin Kumar
20	KSTA regional conference on Science & Technology, JSS college, Mysore (February 21.02.2014 to 22.02.2014) Participants: B. Gangadhara
21	Sericulture Farmers workshop for sustainable livelihood at CSRTI, Mysore, (27.02.2014) **Paricipants:** M. K. Prithvi Raje Urs,S. Gandhi Doss
22	National Conference on Recent Trends in Biosciences – Challenges and Future Prospects organized by the Dept. of Biotechnology, Mar Thoma College of Science and Technology, Ayur, Kollam, Kerala in association with Kerala State Council for Science, Technology & Environment, Thiruvananthapuram, Kerala (13.03.2014 to 15.03 2014) **Paricipant:** E. Rajalakshmi
23	Hindi workshop organized at CSRTI, Mysore. (14.03.2014) **Paricipants:** Dasappa, M. K. Prithviraje Urs, Mukund V. Kirsur, B. Gangadhar, M. G. Sabitha, M. Munirathnam Reddy, Dayanada, D. S. Somaprakash, Manthira Murthy, R. Bhagya, Kariyappa, P. M. Prateesh Kumar, Mary Josepha Sherry
24	Scientists meet at Central office, Central Silk Board, Bangalore (21.03.2014**)** **Paricipants:** Bharat Bhushan Bindroo, G. S. Vindhya, Kannika Trivedi, A. Naseema Begum, T. Thippeswamy, S. K. Aswath, M. Balavenkata Subbaiah, Virendra Kumar, S. B. Nagaraj, V. Premalatha, Dasappa, V. N. Sudha, Vineet Kumar, B. Gangadhar, K. Raja Shekar, Somaprakash, Vinod Kumar, B. T. Srinivasa, M. K. Prithvi Raje Urs, M. Munirathnam Reddy, N. Mal Reddy, Mukund V. Kirsur, M. G. Sabita, K. K. Sharmila, V. Nishitha Naik, A.V. Mary Shery (Joseph), J. B. Narendra Kumar, P.M. Pratheesh Kumar, R. Bhagya, Dayananda, Manthira, S. Moorthy, Y. C. Radhalakshmi, Kariyappa, D. S.
25	Scientists meet at Central office, Central Silk Board, Bangalore (22.3.2014) **Paricipants:** C. Parameswara, S. N. Pallavi, R. S. Katiyar, S. Purushotham, K. P. Shivakumar, P. C. Santha, , A. R. Narasimha Nayaka, Satish B Kulkarni, A. Mahima Santhi, Gandhi Doss, S. Sibayan Sen.

XIX. WEEKLY SEMINARS CONDUCTED AT CSRTI, MYSORE

Sl. No.	Name of the Scientist (s)	Topic of the Seminar	Date
1	Bharat Bhushan Bindroo	General Sericulture Scenario	05.11 .2013
2	Satish Verma	Desiqn of silkworm rearing houses for different agro-climatic conditions	11.11.2013
3	Dasappa	Orqanic farminq and its relevance to mulberry sericulture	11.11.2013
4	Kanika Trivedy	Natural coloured silks- techno-economic feasibilitv	18.11.2013
5	Prithvi Raje Urs, M. K.	Polyploidv breeding in mulberry- past. present and future	18.11.2013
6	Thippeswamy, T.	Problems and prospects of mulberry sericulture in southern peninsular lndia - R& D priorities for the next two decades	25.11.2013
7	Virendra Kumar	Anti-viral proteins and their role in disease resistance in silkworms	25.11.2013
8	Vindhya, G. S.	Present sericulture extension strategies and future prospects	02.12.2013
9	Srinivasa, B. T.	Current status of leaf eaters/defoliators in mulberry	02.12.2013
10	Renukeswarappa, J. P .	Strategies for rapid multiplication and spread of new improved mulberry varieties	09.12.2013
11	Naseema Begum, A. .	Futuristic silkworm breeds for commercial exploitation	09.12.2013
12	Vinod Kumar	Factors responsible for outbreak of uzi fly with remedial measures	16.12.2013
13	Balavenkata Subbaiah, M	Role of insects in spreading silkworm diseases	23.12.2013
14	Sibayan Sen	Phosphorus dynamics in relation to different soil conditions	23.12.2013
15	Ashwath, S. K.	Molecular biology approaches for silkworm improvement	30 12 2013
16	Vinod Kumar Yadav	Package of practices for mulberrv cultivation	30 12 2013
17	Surendra Dutta Sharma	Impact assessment of training programme	06.01.2014
18	Premalatha, V	Breeding strategies for improvement of fibre characters in polyvoltine silkworms	06.01.2014
19	Sudha, V. N.	Training proqrammes for women empowerment	16.01.2014
20	Santha, P. C.	Embryonic studies for efficient handling of silkworm eggs	16.01.2014
21	Munirathnam Reddy, M.	Micronutrients and their role in mulberry nutrition	20.01.2014
22	Gunasekhar, V.	Exploitation of endophytic bacteria for sustainable mulberry cultivation	20.01.2014
23	Mal Reddy, N.	Prospects of bivoltine double hvbrids for maximizing productivity	01.02.2014
24	Rajendra Singh Katiyar	Role of bio fertilizers in mulberry cultivation	01.02.2014
25	Purushotham, S.	Use of rotary mountages for quality cocoon production	03.02.2014
26	Somaprakash, D. S.	Adoption level of new rearing technologies at K.R. Nagar Taluk	03.02.2014
27	Sabita, M. G.	Global climatic change scenario – with emphasis on Indian water resources and agriculture	10.02.2014
28	Girish Naik Vorkady	Mulberry genomics – current status and future directions	10 02 2014
29	Sharmila. K. K.	Biochemical parameters in silkworm improvement	17.02.2014
30	Nishitha Naik, V.	Role of cell wall degrading enzymes in plant pathogenesis	17.02.2014
31	Narendra Kumar, J. B.	Current status of sap suckers in mulberry	24.02.2014
32	Pallavi, S. N.	Heterosis in bivoliine double hvbrids	24.02.2014
33	Vineet Kumar	Role of head sensory receptors of silkworm in discrimination of food plant	03.03.2014
34	Pratheesh Kumar, P. M.	Certain environment friendly means of mitiqatinq plant diseases	03.03.2014
35	Mary Josepha, A. V.	Vector transmission of virus in mulberrv	10.03.2014
36	Bhagya, R.	Cocoon handicraft training programme under ISDS for development of rural women	10.03.2014
37	Narasimha Nayaka, A. R.	Automation of disinfection process- a new tool to avoid potential risks	17.03.2014
38	Gandhi Doss, S.	Techniques in breeding for disease resistance	17.03.2014
39	Dayananda	Breeding strategies for developing polyvoltine breeds tolerant to high temperature and BmNPV	24 03 2014
40	Nagaraja, S. B.	Commercial chawki rearing- problems and prospects	24 03 2014

XX. SERVICES RENDERED

Analysis of materials received from various entities was undertaken and generated revenue of Rs. 2,62,623/-

Sl. No.	Particulars	Number of samples	Revenue Amount (Rs.)
1	Soil	1706	1,21,955.00
2	Bed disinfectants (Vijetha, Vijetha Supplement, Ankush, Vijetha Gold, Ankush, Amruth)	68	1,15,460.00
3	Poshan	05	11,238.00
4	Press mud, FYM/Vermimocpost ,	36	8238.00
5	Leaf	220	4,382.00
6	Navinya	04	900.00
7	Water	10	450.00
	Revenue Generated	**Total**	**2,62,623.00**

XXI. REVENUE GENERATION

I. Details of other miscellaneous receipts of CSRTI, Mysore & RSRS.

Sl. No.	Heads	Amount for the year 13-14 (Upto March,2014) (Rs.)	Percentage
1	Sale-Pesticides	214409.00	5.59
2	Sale – Others	10386.00	0.27
3	Sale – other publications	67832.00	1.77
4	Sale – Fixed Assets	57660.00	1.50
5	Consultancy by Scientists	247920.00	6.46
6	Course Fee	4500.00	0.12
7	Interest receipts	296079.00	7.72
8	Income from Hostel/Guest House	739470.00	19.27
9	Other Misc. receipts	2199061.00	57.31
	Total	**3837317.00**	**10.63**

II. Details of receipts credited to Revolving Fund - Farm development fund pertaining to CSRTI, Mysore & RSRS

Sl. No.	Heads	Amount for the year 13-14 (Upto March,2014) (Rs.)	Percentage
1	Sale-Cocoons/Fruits/Tamarind etc.	1721035.00	55.71
2	Sale – Silk Yarn	170531.00	5.52
3	Sale – Mulberry cuttings	214504.00	6.94
4	Sale – Others (Mulberry leaves)	0.00	0.00
5	Sale – DFL by Institute	65305.00	2.11
6	Brushing charges (chawkie)	874020.00	28.29
7	Sale – Mulberry saplings	43961.00	1.42
	Total	**3089356.00**	**8.56**

III. Details of receipts credited under training fund account

Sl. No.	Heads	Amount for the year 13-14 (upto March, 2014) (Rs.)	Percentage
1	Course Fee	567632.00	91.09
2	Project Fee	55500.00	08.91
	Total	**623132.00**	**01.73**

IV. Details of receipts credited under Sericulture Engineering Division/revolving account

Sl. No.	Heads	Amount for the year 13-14 (upto March, 2014) (Rs.)	Percentage
1	Revolving Fund	514728.00	-
	Total	**514728.00**	01.43

V. Details of receipts credited under fixed deposit

Sl. No.	Heads	Amount for the year 13-14 (upto March, 2014) (Rs.)	Percentage
1	Training Division Fund	2004423.00	07.15
2	Farm Development Fund	26019803.00	92.85
	Total	**28024226.00**	77.65
Grand Total Revenue generated I-V		**36088759.00**	**09.33**
Total Grants received upto March, 2014 (Non Plan)		**386922821**	**-**

XXII. TECHNOLOGIES UNDER THE PROCESS OF PATENTING AND COMMERCIALISATION

#	Technology/Products	Date of filing	Present status
1	A machine for harvesting silkworm cocoons from plastic collapsible mountages	6.6.13 (Patent)	NRDC Ref.No. IPR/FA/13016/2013/ 30.07.2013
		7.6.13 (Technology offer)	Technology **commercialized** to M/S Raj Enterprises, Mysore through NRDC (January 2014)
2	Seri room heater	6.6.13 (Patent)	NRDC Ref.No .IPR/FA/13014/2013/ 30.07.2013
		6.11.12 (Technology offer)	Technology **commercialized** to M/S Raj Enterprises, Mysore through NRDC (January 2014)
3	Chawki worm dusting machine	28.6.13 (Patent)	NRDC Ref.No.IPR/FA/13015/2013/ 30.07.2013
		10.7.13 (Technology offer)	Technology offer submitted to NRDC for commercialization
4	Nemahari	20.6.2013 (Technology offer)	Assignment deed executed on 20.06.2013
5	Process for utilization of spent silkworm moths for value added by-products	10.7.13 (Patent)	NRDC Ref.No. IPR/FA/13018/2013/ 30.07.2013
6	PVC stands for rearing young age silkworm rearing (Chawki stands)	17.8.13 (Patent)	NRDC Ref.No. IPR/FA/13022/2013/ 26.08.2013
		17.8.13 (Technology offer)	Technology offer submitted to NRDC for commercialization
7	Water jetting system – for management of sucking pests in mulberry	22.8.13 (Patent)	NRDC Ref.No. IPR/FA/13023/2013/ 29.08.2013
8	A process for culturing *Cordyceps* using silkworm	12.02.2014 (Patent)	NRDC Ref. No.IPR/FA/13056 / 13.03.2014

XXIII. ROYALTY RECIEVED

Premia paid and royalty recived from NRDC, Bangaluru pertaining to various products innovated and commercialized by this institute during 2010-11 as communicated by Central office is as follows.

Sl.No.	For the year	Premia (Rs.)	Royalty (Rs.)
1	2010-11	18,90,000.00	8,42,606.24

XXIV RIGHT TO INFORMATION ACT 2005 (RTI)

Name of CPO: Dr. B.B.Bindro, Director, CSRTI, Mysore

Sl. No.	Date of request	Date of compliance and letter No. and date		
1.	10.04.2013	No.CSB/RTI/SEEM/RTI ACT2005/2013-14/23-24	dated	20.03.2013
2.	22.05.2013	No.CSB/RTI/SEEM/RTI ACT2005/2013-14/265-266	dated	21.06.2013
3.	15.06.2013	No.CSB/RTI/SEEM/RTI ACT2005/2013-14/ 305	dated	02.07.2013
4	24.06.2013	No.CSB/RTI/SEEM/RTI ACT2005/2013-14/503	dated	22.08.2013
5	20.08.2013	No.CSB/RTI/SEEM/RTI ACT2005/2013-14 /870-871	dated	26.12.2013
6	29.08.2013	No.CSB/RTI/SEEM/RTI ACT2005/2013-14 690-691	dated	07.10.2013
7	29.08.2013	No.CSB/RTI/SEEM/RTI ACT2005/2013-14 /713-714	dated	10.10.2013
8	04.01.2014	No.CSB/RTI/SEEM/RTI ACT2005/2013-14/1026	dated	25.01.2014
9	04.01.2014	No.CSB/RTI/SEEM/RTI ACT2005/2013-14 /1029-30	dated	27.01.2014
10.	25.01.2014	No.CSB/RTI/SEEM/RTI ACT2005/2013-14/ 1072-73	dated	19.02.2014
11	25.01.2014	No.CSB/RTI/SEEM/RTI ACT2005/2013-14 / 1094	dated	22.02.2014
12	04.02.2014	No.CSB/RTI/SEEM/RTI ACT2005/2013-14/ 1109-10	dated	03.03.2014

XXV. LIST OF DIGNITARIES WHO VISITED THE INSTITUTE

#	Name of visitors/ dignitaries	Address	Date of visit
1	Mr. Kim Jong Bin	Director General of Sericulture & Silk Industry South Korea	13.06.2013
2	Sri. P. Phukan	Director of Sericulture, DoS, Assam	12.08.2013
3	Dr. M. RamaKrishana	Loyal Textile Mills, Chennai	13.08.2013
4	Sri. S. Saravanan	Loyal Textile Mills, Chennai	13.08.2013
5	Mr. Akio Yamaguchi	JICA Expert, Japan	21.08.2013
6	Ms. Erico Kawaguchi	JICA Expert, Japan	21.08.2013
7	Prof. Avadesh Kumar Mishra	Director Bharatiya Bhasha Sansthal, CIIL, Mysore	16.09.2013
8	Dr. Ghanshyam Sharma	Chairman, UCRF, Uttarakhand	27.09.2013
9	Dr. S. M. Sharma	Director of Sericulture, Uttarakhand	27.09.2013
10	Padmabhushan Prof. Mahadevappa, M.	RCC, Chairman, CSB, Bangalore	26.10.2013
11	Sri Rudramuni	District and Session Judge, Law Courts, Mysore	01.11.2013
12	Sri. Phukay Sumi	Ministry of Sericulture & Women Development, Govt. of Nagaland, India	08.11.2013
13	Sri . N. S. Bisse Gowda	CSB Chairman, Bangalore	03.12.2013
14	Sri. M. P. Lakshmikant	CSB Board Member, Bangalore	03.12.2013
15	Sri . Umesha Babu	CSB Board Member, Bangalore	03.12.2013
16	Sri . R. N. Reddy	CSB Board Member, Bangalore	03.12.2013
17	Sri . R. K. Ramakrishna	CSB Board Member, Bangalore	03.12.2013
18	Ms. Ishita Roy, IAS,	Member Secretary, CSB, Bangalore	13.12.2013
19	Sri . R. Satish Kumar	Director, Finance, CSB, Bangalore	24.01.2014
20	Sri . N. S. Bisse Gowda	CSB Chairman, Bangalore	28.01.2014
21	Ms. Ishita Roy, IAS,	Member Secretary, CSB, Bangalore	28.01.2014
22	Padmabhushan Prof. Mahadevappa, M.	RCC, Chairman, CSB, Bangalore	28.01.2014
23	Dr. R. K. Datta	Ex. Director, CSRTI, Mysore	28.01.2014
24	Dr. M. N. Narasimhanna	Ex. Director, NSSP, Bangalore	28.01.2014
25	Sri. Ajay Shankar, IAS	Member Secretary, National Manufacturing Competitiveness Council, New Delhi	03.02.2014
26	Dr. A. D. Jadhav	Dept. of Zoology, Shivaji University, Kolhapur, Maharashatra	03.02.2014
27	Dr. S. R. Yankanchi	Dept. of Zoology, Shivaji University, Kolhapur, Maharashatra	03.02.2014

XXVI. METEOROLOGICAL DATA

Meteorological data for the Year 2013

Station: CSR&TI, Mysore

Month	Temperature [^{0}C]			Humidity [%]			Rainfall [mm]
	Maximum	Minimum	Average	Maximum	Minimum	Average	
January	32.40	09.10	22.69	98	28	56.40	0.00
February	33.50	10.80	24.61	87	16	52.11	1.20
March	36.60	14.30	27.10	78	16	47.29	4.00
April	36.90	18.70	28.56	93	21	54.71	41.90
May	36.10	16.50	26.58	87	37	62.68	101.00
June	30.80	18.00	23.94	95	43	78.16	64.60
July	33.80	18.50	24.24	96	59	79.65	77.60
August	32.10	18.70	23.52	97	47	78.16	41.10
September	32.10	18.50	25.05	98	56	79.23	71.50
October	31.80	17.00	24.52	96	58	77.21	104.70
November	30.50	17.00	24.48	96	37	72.33	78.80
December	29.90	13.20	22.89	83	34	61.19	0.00
Extm. High	36.90	18.70		98.00	59.00		104.70
Extm. Low	29.90	09.10		78.00	16.00		1.20
						Total Rainfall	**586.40**
						No. of rainy days	**51**

Station: RSRS, Kodathi

Month	Temperature [^{0}C]			Humidity [%]			Rainfall [mm]
	Maximum	Minimum	Average	Maximum	Minimum	Average	
January	30	15	22.5	85	77	81.0	0.00
February	32	17	24.5	85	75	80.0	0.00
March	36	18	27.0	85	69	77.0	0.00
April	37	21	29.0	89	72	80.5	17.25
May	36	22	29.0	87	71	79.0	32.45
June	34	20	27.0	85	72	78.5	97.50
July	29	20	24.5	92	70	81.0	78.00
August	30	20	25.0	85	75	80.0	0.00
September	33	20	26.5	92	72	82.0	196.00
October	30	19	24.5	85	76	80.5	73.75
November	30	20	25.0	84	69	76.5	66.25
December	28	16	22.0	85	63	74.0	0.00
Extm. High	37	22	29.5	92	76	84.0	196.00
Extm. Low	28	15	21.5	76	63	69.5	17.25
						Total Rainfall	**561.20**
						No. of rainy days	**64**

Station: RSRS, Chamarajanagar

Month	Temperature [^{0}C]			Humidity [%]			Rainfall [mm]
	Maximum	Minimum	Average	Maximum	Minimum	Average	
January	30.40	13.40	21.90	68.90	48.40	58.65	0.80
February	33.10	14.50	23.80	61.00	36.00	48.50	-
March	35.40	18.50	26.95	61.00	26.00	43.50	-
April	35.60	20.60	28.10	69.10	46.10	57.60	55.70
May	34.10	21.30	27.70	76.10	52.10	52.1	77.80
June	32.00	20.30	26.15	70.00	57.90	63.95	3.20
July	30.80	20.10	25.45	74.60	61.40	68.00	62.00
August	30.80	19.80	25.30	75.70	63.70	69.70	40.00
September	32.10	19.30	25.70	71.70	55.10	63.40	23.20
October	30.90	18.60	24.75	75.30	59.40	67.35	102.80
November	30.00	15.40	22.70	71.10	54.20	62.65	52.00
December	30.90	14.20	22.55	65.40	47.90	56.65	3.80
Extm. High	35.40	21.30	-	76.10	63.70	-	-
Extm. Low	30.00	14.20	-	61.00	26.00	-	-
						Total Rainfall	**421.28**
						No. of rainy days	**64**

Station: RSRS, Ananthapur

Month	Temperature [^{0}C]			Humidity [%]			Rainfall [mm]
	Maximum	Minimum	Average	Maximum	Minimum	Average	
January	29.0	21.0	25.0	65.0	42.0	53.5	-
February	34.0	23.0	28.5	58.0	41.0	49.5	-
March	38.0	27.0	32.5	55.0	37.0	46.0	-
April	34.0	20.0	27.0	66.0	41.0	53.5	-
May	41.0	20.0	30.5	60.0	37.0	48.5	-
June	40.0	24.0	32.0	72.0	30.0	51.0	121
July	38.0	22.0	30.0	60.0	31.0	71.0	22.8
August	37.0	21.0	29.0	66.0	41.0	53.5	53.8
September	34.0	24.0	29.0	78.0	45.0	61.5	230.6
October	33.0	24.0	28.5	71.0	46.0	58.5	-
November	31.0	25.0	28.0	76.0	48.0	62.0	-
December	30.0	23.0	26.5	81.0	65.0	73.0	-
Extm. High	41.0	27	-	81	65	-	-
Extm. Low	30	20	-	55	30	-	-
						Total Rainfall	**428.2**
						No. of rainy days	**30**

Station: RSRS, Salem

Month	Temperature [^{0}C]			Humidity [%]			Rainfall [mm]
	Maximum	Minimum	Average	Maximum	Minimum	Average	
January	30.7	19.4	25.0	39.6	31.3	35.4	0.0
February	32.0	20.9	26.4	60.4	37.7	49.0	3.0
March	34.0	19.7	26.7	59.8	23.8	41.8	0.0
April	32.9	23.9	28.4	61.2	32.2	46.6	19.0
May	34.8	23.4	29.1	66.0	29.8	47.9	20.0
June	30.7	25.3	28.0	72.7	57.7	65.2	94.5
July	31.0	23.0	27.0	70.3	45.6	57.9	33.0
August	30.3	21.9	26.1	75.1	55.6	65.3	285.0
September	31.2	23.5	27.3	75.9	58.4	67.2	202.5
October	30.8	23.5	27.1	77.5	59.3	68.4	145.0
November	30.1	23.0	26.5	74.4	64.7	69.6	45.6
December	28.4	21.6	25.0	76.8	69.9	73.3	17.0
Extm. High	34.8	25.3	30.0	77.5	69.9	73.7	285.0
Extm. Low	28.4	19.4	23.9	39.6	29.8	34.7	0.0
						Total Rainfall	**864.6**
						No. of rainy days	**62**

XXVII. RESEARCH PUBLICATIONS

Research papers A. International journal		27
B. National journals		35
Popular articles		09
Books		02
Booklet/Technical bulletin		05
News/reports/silk briefs		43
Extension manuals/brochures/pamphlets		50
Papers/Abstracts of presented in seminar/workshop/ conference	A. International	20
	B. National	67
Grand Total		**258**

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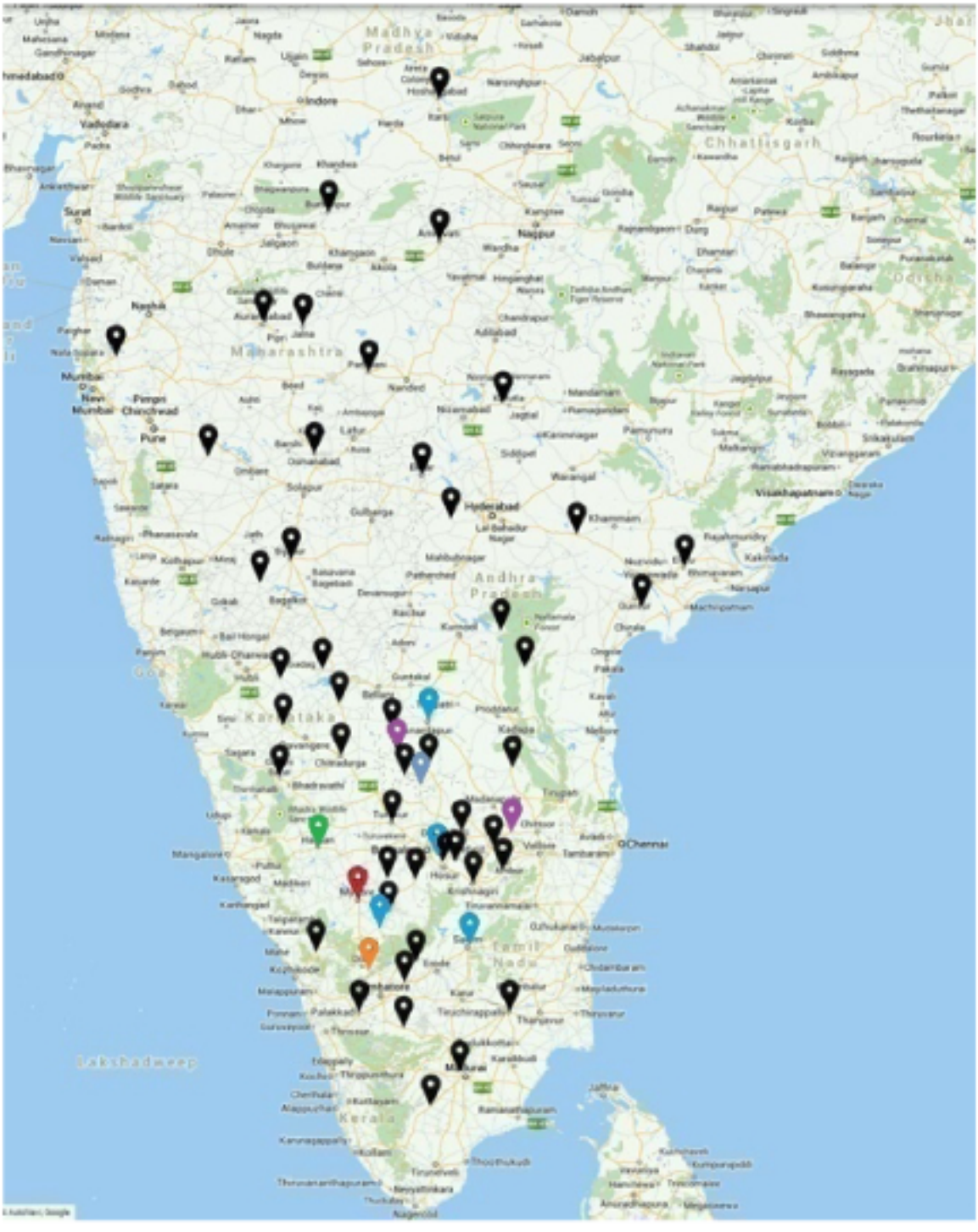

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Cluster Dev. Centre	02	SU of Research Extension Centres	28
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Published by Dr. B.B. Bindroo

निदेशक/Director

केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान

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