

सं./No. 51

केन्द्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान CSRTI-MYSURU

वार्षिक प्रतिवेदन ANNUAL REPORT 2014 - 15



केन्द्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान

(आई एस ओ 9001 : 2008 प्रामाणित)

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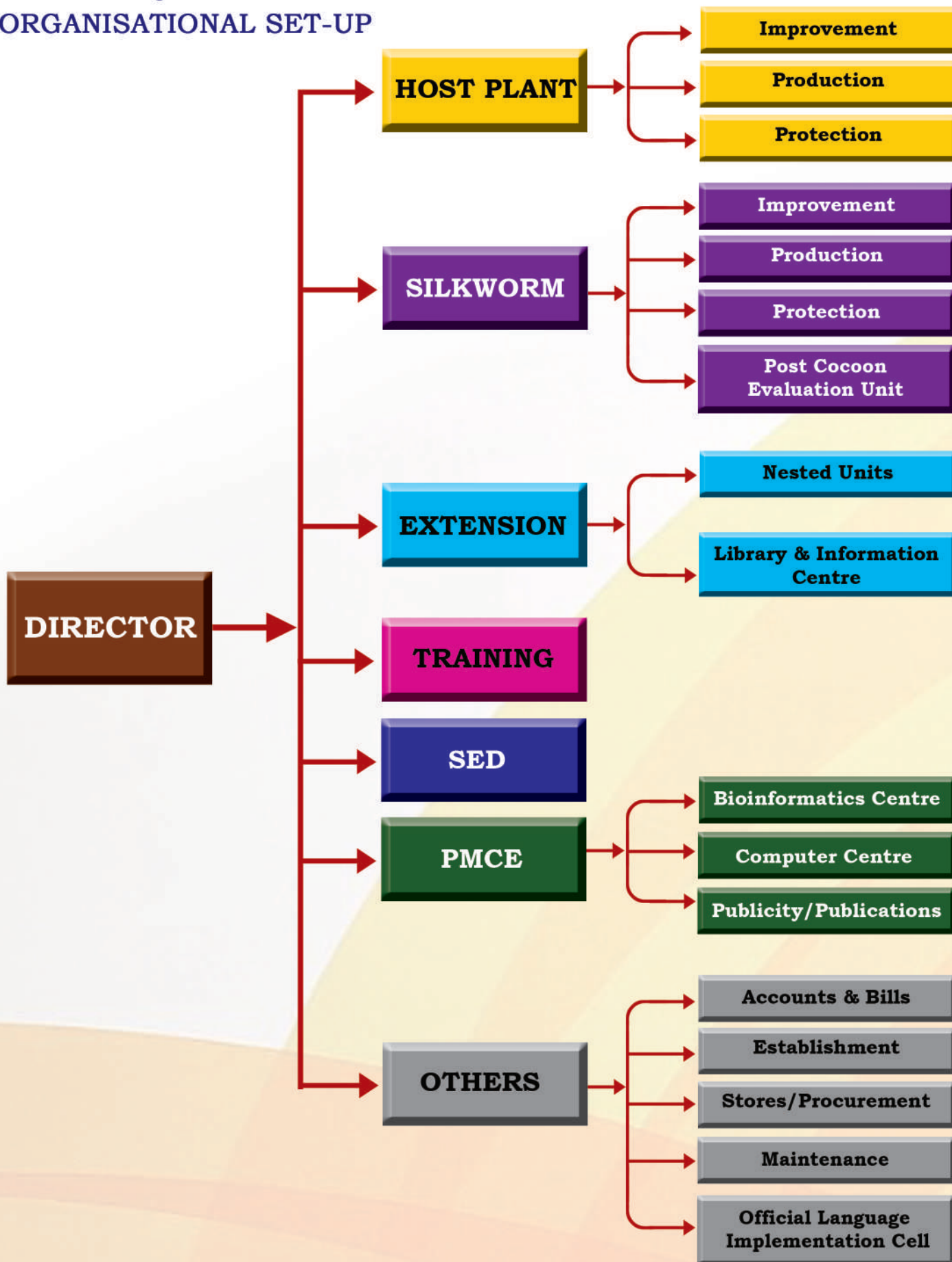
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Central Silk Board, Ministry of Textiles, Government of India, Mysuru - 570 008

CSRTI-Mysuru

ORGANISATIONAL SET-UP



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CSRTI, Mysuru

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केंरेअप्रसं, मैसूरु एक उन्नतिशील संस्थान है और इसकी वार्षिक रिपोर्ट प्रस्तुत करते हुए मुझे प्रसन्नता हो रही है । हमने अपने आपको निडर और कल्पनाशील बनाने का संकल्प लिया है तथा विगत उपलब्धियों और सुविज्ञता को कायम रखने का भी निश्चय किया है । परंतु इससे भी आगे बढ़ना ही हमारा लक्ष्य है । इन पत्रों पर अंकित परिणामों से हम उत्साहित है । अनुसंधान एवं विकास की मुख्य उपलब्धियाँ निम्नानुसार है : आशाजनक शहतूत जीनप्ररूपों, जिनसे अंतिम उपज मूल्यांकन में वी1 उपजाति से अधिक उपज प्राप्त हुई, की पहचान, मूल्यांकन हेतु तीन उत्पादकों एवं दो बी एम एन पी वी सहनशील संकरों और चार

ताप सहिष्णु रेशमकीट वंशों का विकास, अंतर्राष्ट्रीय श्रेणी के रेशम का उत्पादन करने वाला उन्नत संकर "कावेरी गोल्ड" का विकास और सिमटने वाली चंद्रिकाओं के लिए कोसा एकत्रित करने के यंत्र का विकास तथा ट्रे धुलाई सह विसंक्रमण यंत्र आदि ।

देश की मुख्य द्विप्रज रेशम उत्पादन पद्धतियों को साकार रूप देने तथा आंध्रप्रदेश, कर्नाटक, केरल, तमिलनाडु, तेलंगाना और महाराष्ट्र में समन्वित समूह संवर्द्धन कार्यक्रम संचालित करने में कें रे अ प्र सं, मैसूरु एक मुख्य साधन है । कें रे बो और रेशम उत्पादन विभाग के कार्मिकों के प्रभावी समन्वित प्रयासों के फलस्वरूप 106 समूहों द्वारा कुल कच्चे रेशम उत्पादन का 60% अर्थात् 2241 मी ट प्राप्त हुआ, जो रिकार्ड है । संपूर्ण प्रौद्योगिकी स्थानांतरण हेतु 11 स्थानों पर संस्थान ग्राम संबद्ध कार्यक्रम (सेरि आदर्श ग्राम) पुनःप्रारंभ किया गया है जिससे कोसा उपज में 8.5% वृद्धि हुई । जापान समुद्रोपरि सहकारिता स्वयंसेवकों ने द्विप्रज रेशम उत्पादन कार्यक्रमों को बढ़ावा देने हेतु सी बी ओ विकसित करने के लिए आंध्रप्रदेश, तमिलनाडु और कर्नाटक में कार्य प्रारंभ किया है । रेशम उत्पादन की नवीनतम प्रौद्योगिकियों को कृषक कार्यशाला और विस्तारण कार्यक्रम आयोजित करते हुए कृषकों को हस्तांतरित किया गया ।

इस वर्ष कोसा प्राप्ति यंत्रों का प्रदर्शन करने हेतु राष्ट्रीय अनुसंधान विकास निगम द्वारा प्रायोजित उद्यमी विकास कार्यक्रम का प्रारंभ किया गया । संस्थान द्वारा विकसित आठ प्रौद्योगिकियों को राष्ट्रीय अनुसंधान विकास निगम के माध्यम से उद्यमियों के लिए वाणिज्यीकृत किया गया ताकि उसका प्रभावी ढंग से आपूर्ति और उपयोग किया जा सके । वैज्ञानिक आविष्कारों से संबंधित छः एकस्व आवेदन पत्रों को समाशोधन हेतु राष्ट्रीय जैव विविधता प्राधिकारी को प्रस्तुत किया गया । हमारे संस्थान के वैज्ञानिकों ने रेशम उत्पादन संबंधी अनुसंधान के परिणामों, लोकप्रिय लेखों तथा प्रौद्योगिकी चौपत्रों को प्रकाशित करने हेतु काफी योगदान दिया है ।

रेशम उत्पादन क्षेत्र के लिए कुशल मानवशक्ति सृजित करना हमारे संस्थान के महत्वपूर्ण अधिदेशों में से एक है । चालू वर्ष भी संस्थान के लिए महत्वपूर्ण रहा, इस दौरान एकीकृत कुशलता विकास योजना के अंतर्गत 499 लाभार्थियों सहित कई पणधारियों को विभिन्न पहलुओं में और संरचित तथा आवश्यकता आधारित कार्यक्रमों के अंतर्गत 751 लाभार्थियों को एवं चॉकी कीटपालन कार्यकलापों में 127 उद्यमियों को प्रशिक्षित किया गया । बंगलादेश, फिलिपइन्स, उगांडा, थाइलैन्ड और ईजिप्ट के 14 प्रशिक्षार्थियों के लिए विदेश मंत्रालय द्वारा प्रायोजित रेशम उत्पादन और रेशम उद्योग पर आई टी ई सी (भारतीय तकनीकी एवं आर्थिक सहकारिता) प्रशिक्षण कार्यक्रम प्रारंभ किया गया ।

रेशम उत्पादन एवं इसकी सुस्थिरता बढ़ाने हेतु शहतूत उपजातियों, रेशमकीट संकरों एवं प्रौद्योगिकी अभिनवकरणों का अवलोकन किया जा रहा है । अधिक उत्पादक एवं नई प्रौद्योगिकियाँ विकसित करने हेतु चालू वर्ष में विविध, प्रयोजन मूलक और अभिनवी कार्योन्मुख साझेदारी कार्यक्रमों के ज़रिए कई अनुसंधान व विकास कार्यक्रम प्रारंभ किए गए । मुझे विश्वास है कि जैसे जैसे हम सीखेंगे, हमारी समझ बढ़ेगी और हम अपने सलाहकारों और पणधारियों की सहभागिता से रेशम उत्पादन को सुस्थिर बनाने में अधिक सक्षम होंगे ।

वी. शिवप्रसाद

डॉ. वी. शिवप्रसाद, निदेशक

FOREWORD

CSRTI-Mysuru is a thriving institution and it is privilege to present the annual report. We challenged ourselves to be bold & imaginative; also determined to build on past accomplishments and expertise, but not rest on them. We are excited about the outcomes described in these pages. Major achievements from R&D includes identification of promising mulberry genotypes, which out-yielded V1 variety for final yield evaluation; development of three productive and two BmNPV tolerant bivoltine hybrids for evaluation and four thermo-tolerant silkworm lines; development of 'Cauvery Gold', an improved crossbreed producing international grade silk; development of cocoon harvesters for collapsible mountages and tray washing cum disinfection machine.

CSRTI-Mysuru is the major instrument towards achieving the country's bivoltine silk production plans and coordinated cluster promotion programme in South Zone in Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Tamil Nadu, Telangana and Maharashtra. About 60% of total bivoltine raw silk production, 2241 MT, which is an all-time record, was produced through 106 clusters by effective coordinated efforts of CSB and DOS personnel. Institute Village Linkage Programme (Seri Model Village) was re-initiated at 11 locations for complete transfer of technology, which recorded 8.5% improvement in cocoon yield. Japan Overseas Cooperation Volunteers (JOCV) have initiated works in Andhra Pradesh, Tamil Nadu and Karnataka for developing CBOs in further improving bivoltine sericulture programmes. The latest developments in sericulture are delivered to the farmers by organizing extension communication programmes including farmers' workshops.

The year witnessed initiation of an EDP sponsored by NRDC for the demonstration of cocoon harvesters. Eight technologies developed by the institute were commercialized through NRDC to entrepreneurs for effective supply and utilization. Six patent applications on scientific inventions were submitted to National Biodiversity Authority for clearance. The scientists of our institution contributed intellectually in publishing research results, popular articles and technology brochures in sericulture.

Generation of skilled manpower for sericulture sector is one of the critical mandates of our institution. The current year was no different and several stakeholders were trained in various aspects including 499 beneficiaries under Integrated Skill Development Scheme (ISDS); 751 under structured and need based programmes including 127 entrepreneurs in CRC activities. An ITEC (Indian Technical & Economic Cooperation) training programme on Sericulture and Silk Industry sponsored by Ministry of External Affairs: Govt. of India was also initiated for 14 trainees from Bangladesh, Philippines, Uganda, Thailand and Egypt.

Further, a growing pipeline of mulberry varieties, silkworm hybrids and technological innovations are being perused for improving the productivity and sustainability of sericulture. Several R&D programmes were initiated in the current year with diverse, purposeful, innovative and action-oriented partnerships for developing more productive and resilient technologies. I am hopeful that as we learn, our understanding will grow and we together with our advisories and stakeholders as partners will become even more effective in making sericulture sustainable.



Dr. V. Sivaprasad, Director

कें.रे.अ.प्र.सं. मैसूरु के बारे में

केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, मैसूरु केंद्रीय रेशम बोर्ड, वस्त्र मंत्रालय, भारत सरकार के तत्वावधान में संस्थापित हुआ। वर्ष 1961 में संस्थान का कार्य चन्नपट्टणा में प्रारंभ हुआ और बाद में 1963 में इसे मैसूरु स्थानांतरित किया गया। प्रशिक्षण घटक को सम्मिलित करने के बाद इस संस्थान का वर्ष 1965 में केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, मैसूरु (केंरेअप्रसं) के रूप में पुनर्नामकरण किया गया। यह संस्थान देश में रेशम उद्योग के विकास के लिए पिछले 60 सालों से अच्छी सेवाएं समर्पित कर रहा है। संस्थान को आई एस ओ 9001:2008 से प्रमाणित (2013) किया गया है जो रेशम उत्पादन उद्योग के विकास हेतु अनुसंधान व विस्तारण में गुणवत्ता प्रबंधन और समर्थन सेवाओं में उत्कृष्टता के लिए हमारी वचनबद्धता का प्रमाण है।

आज यह संस्थान अनुभवी वैज्ञानिकों, समस्त आधुनिक सुविधाओं एवं अवसरचनयुक्त रेशम उत्पादन अनुसंधान के उत्कृष्ट प्रमुख संस्थान के रूप में विख्यात है। इस संस्थान ने देश तथा विदेश में उष्णकटिबंधीय रेशम उत्पादन में अग्रणी अनुसंधान व विकास संस्थान के रूप में यश प्राप्त किया है और इसे उच्च अध्ययन एवं उन्नत प्रशिक्षण केंद्र के रूप में मान्यता प्राप्त है। यह संस्थान कर्नाटक, आंध्रप्रदेश, तमिलनाडु, तेलंगाना, 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 करता है। अभी तक इस संस्थान ने रेशम उत्पादन प्रौद्योगिकी के विभिन्न पहलुओं में 800 विदेशियों सहित करीब 50,000 व्यक्तियों को प्रशिक्षित किया है। यह संस्थान अनुसंधान, प्रशिक्षण एवं विस्तारण कार्य संचालित करने के अलावा राष्ट्रीय एवं अंतर्राष्ट्रीय अभिकरणों को परामर्श एवं सलाहकारी सेवाएँ भी प्रदान करता है।

दृष्टि	
द्विप्रज रेशम उत्पादन में श्रेष्ठ अंतर्राष्ट्रीय रेशम उत्पादन संस्थान बनना	
लक्ष्य	उद्देश्य
भारतीय रेशम उत्पादन उद्योग को आजीविका स्तर के उत्पादन से प्रतियोगी वाणिज्यिक उत्पादन के आधार में परिणत करने हेतु अनुप्रयोग आधारित अनुसंधान में श्रेष्ठता हासिल करना।	<ul style="list-style-type: none"> ● भारतीय रेशम का उत्पादन, उत्पादकता एवं गुणवत्ता बढ़ाने हेतु अनुसंधान। ● शहतूत एवं रेशम कीटपालन के लिए पैकेज प्रणाली विकसित करना। ● उत्पादों और प्रौद्योगिकियों का वाणिज्यीकरण। ● स्थानांतरण प्रौद्योगिकी। ● प्रौद्योगिकी स्थानांतरण के माध्यम से आयातित रेशम के बदले रेशम उत्पादन बढ़ाना। ● प्रशिक्षण ● अनुसंधान कार्यक्रमों के समर्थन के लिए संस्थान के ढाँचे को मज़बूत बनाना। ● प्रजनक स्टॉक का अनुरक्षण। ● रोग पूर्वानुमान एवं पूर्वसूचना। ● अनुसंधान एवं विकास अभिनवों और पैकेज प्रणाली का प्रकाशन। ● भारत और विदेश में अन्य अनुसंधान व विकास संगठनों के साथ सहयोगी अनुसंधान।

संगठनात्मक रचना

केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, मैसूरु, 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 कार्मिक कर्नाटक, तमिलनाडु, आंध्रप्रदेश, तेलंगाना, केरल, महाराष्ट्र और मध्यप्रदेश राज्यों के मुख्य संस्थानों और संबद्ध एककों के माध्यम से 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। कें रे अ प्र सं, मैसूरु अधिदेशात्मक कार्य निपटाने हेतु कई योग्य तकनीकी एवं प्रशासनिक कर्मचारियों

की सेवा का भी उपयोग करता है। 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। राष्ट्रीय एवं अंतर्राष्ट्रीय पत्रिकाओं में प्रकाशित तकनीकी एवं अनुसंधान शोध-पत्रों के अलावा 35 पुस्तकें भी प्रकाशित की गई हैं। संस्थान को अंतर्राष्ट्रीय ख्याति की द्वि वार्षिक पत्रिका इंडियन जर्नल ऑफ सेरिकल्चर और रेशम उत्पादन विज्ञान पर दस्तावेजी साहित्य सेरिडॉक प्रकाशित करने की प्रतिष्ठा प्राप्त हुई।

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। महाराष्ट्र एवं मध्यप्रदेश के साथ दक्षिण राज्यों में भी द्विप्रज रेशम उत्पादन को बढ़ावा देने हेतु कें रे अ प्र सं, मैसूर, 106 समूहों (समूह संवर्धन कार्यक्रम) और ग्यारह सं ग्रा सं का केंद्रों का समन्वयन करता है। राज्य रेशम उत्पादन विभागों के तकनीकी कार्मिकों के समन्वयन से प्रौद्योगिकियों का प्रभावी स्थानांतरण किया गया है।

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 राष्ट्रीय एवं अंतर्राष्ट्रीय स्तर पर उष्णकटिबंधीय रेशम उत्पादन में प्रशिक्षण देता है। यह संस्थान रेशम उत्पादन प्रौद्योगिकी एवं जैव सूचना विज्ञान में अनुसंधान एवं रेशम उत्पादन में पीएच डी कार्यक्रम संचालित करने हेतु मैसूर विश्वविद्यालय से संबद्ध है। यह संस्थान ग्रामीण गरीब लोगों, कमजोर वर्गों और महिला रेशम उत्पादकों के सामाजिक-आर्थिक विकास के लिए और प्रौद्योगिक सशक्तिकरण हेतु जैव प्रौद्योगिकी विभाग एवं विज्ञान व प्रौद्योगिकी विभाग, भारत सरकार द्वारा प्रायोजित विभिन्न प्रशिक्षण कार्यक्रम संचालित करते हैं। 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 योग्य संकाय सदस्यों द्वारा कार्यक्रम संचालित किए जाते हैं। करीब 125 व्यक्तियों को ठहराने हेतु छात्रावास सुविधाएँ उपलब्ध हैं।

अवसंरचना सुविधाएँ

- रेशम उत्पादन विज्ञान में उन्नत अनुसंधान संचालित करने हेतु सुसज्जित प्रयोगशालाएँ, शहतूत बाग और कीटपालनगृह।
- प्रौद्योगिकी मान्यकरण एवं किसानों को प्रशिक्षण देने हेतु बड़े पैमाने पर कीटपालन गृह।
- चॉकी कीटपालन केन्द्र संकल्पना को बढ़ावा देने हेतु आदर्श चॉकी कीटपालन केन्द्र।
- यंत्रों/उपस्करों के अभिकल्प एवं विकास तथा संरचना को समर्थित करने हेतु सभी सुविधाओं से युक्त रेशम उत्पादन अभियांत्रिकी प्रभाग।
- संबद्ध एककों, रेशम उत्पादन विभागों और अन्य संगठनों के साथ प्रभावी पारस्परिक संपर्क के लिए कें रे अ प्र सं, मैसूर में संस्थापित विडियो सम्मेलन स्टुडियो, प्रौद्योगिकी का तेजी से संप्रेषण एवं प्रभावी स्थानांतरण सुनिश्चित करता है।
- कंप्यूटर सेन्टर द्वारा लान के माध्यम से प्रिन्ट /फाइल शेयर समर्थन सहित सभी को इन्टरनेट कनेक्शन दिया गया है।
- जैव सूचना विज्ञान केन्द्र आंकड़े संचय की पुनः प्राप्ति सेवा प्रदान करता है।
- पुस्तकालय सेवाएँ (10763 पुस्तकें, 6962 वैज्ञानिक पत्रिकाओं का बंध खंड, 80 पत्रिकाएँ, शोध पत्र 292, प्रबंध-26 तकनीकी रिपोर्ट एवं सीडी रॉम डेटा बेस -एग्रिस, बयोसिस बयोटेक्नॉलजी साइटेशन इन्डेक्स, एकस्व)।

ABOUT CSRTI-MYSURU

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

The Institute has the distinction of being premier institution for sericulture research par excellence with all modern facilities and infrastructure including experienced scientific personnel. CSRTI has made mark as a leading R & D institution for quality research and services on tropical sericulture in the country and abroad and is well recognized as center for higher learning and advanced training. CSRTI caters to the need of on-farm sector of mulberry sericulture in Karnataka, Andhra Pradesh, Tamil Nadu, Telangana, Kerala, Maharashtra and Madhya Pradesh. To date CSRTI trained about 50,000 persons including 800 foreign nationals in various aspects of sericulture technology. The institute besides conducting research, training and extension activities, also offers consultancy and advisory services to national and international agencies.

Vision	
To become an International Sericulture Institute par-excellence in Bivoltine Sericulture	
Mission	Objectives
To achieve excellence in application oriented research to transform Indian Sericulture industry from the subsistence level of production to a vibrant competitive commercial production base	<ul style="list-style-type: none"> • Research to enhance production, productivity and quality of Indian silk • Development of package of practices for mulberry and silkworm rearing • Commercialization of products and technologies • Transfer of technology • Enhance production of import substitute silk through transfer of technology • Training • Strengthening institutional framework to support research programmes • Maintenance of breeders stock • Disease forecasting and forewarning • Publication of R&D innovations and package of practices • Collaborative research with other R&D organizations in India and abroad

Organization Setup

CSRTI-Mysuru is the largest and most diversified institution engaged in sericulture R & D in the country, supported by about 150 scientists of various disciplines including agricultural engineers, sociologists and economists. These personnel working in close coordination for the development of appropriate technologies and their transfer through the main institute and its nested units spread in the states of Karnataka, Tamil Nadu, Andhra Pradesh, Telangana, Kerala, Maharashtra and Madhya Pradesh. R & D activities and technology development are carried out in four major divisions: Host Plant Production & Protection, Silkworm Production & Protection, Extension and Training. CSRTI-Mysuru also utilizes the services of several able technical and administrative staff in undertaking the mandated activities. The Director monitors the progress of R & D activities of Institute and nested units with the support of Planning, Monitoring,

Coordination and Evaluation cell. CSRTI-Mysuru regularly publishes books, bulletins, leaflets and technical pamphlets. Over 35 books have been brought out so far in addition to 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 and Seridoc - documenting literature on sericultural sciences.

Extension Network

CSRTI-Mysuru has a three-tier system of extension network: Regional Sericultural Research Stations (RSRS), Research Extension Centres (REC) and Sub-Units (REC-SU) to facilitate validation and translation of laboratory findings effectively to the field. RSRSs are located in major sericultural zones of Southern States carryout region-specific adaptive and applied research. Technology trials are also conducted to suit the regional requirements besides providing training to farmers and grassroot level extension staff. RECs and sub-units share the major responsibility of technology transfer to the beneficiaries and also provide technological inputs and support services. CSRTI-Mysuru coordinates 106 clusters (Cluster Promotion Programme) and eleven IVLP centers for the promotion of bivoltine sericulture in Southern States along with Maharashtra and Madhya Pradesh. Effective transfer of technologies is undertaken in close coordination with technical personnel of State Departments of Sericulture.

Training Centre

CSRTI-Mysuru is recognized as flagship centre for generation of trained human resource in tropical sericulture at international and national level. The Institute is affiliated to University of Mysuru for conducting research including Ph.D. programmes. CSRTI-Mysuru also conducts training programmes sponsored by DBT, DST and Ministry of Textiles: Govt. of India for socio-economic and technological empowerment of the rural poor, weaker sections and women sericulturists. Besides catering to the HRD needs of the state departments of sericulture in the country, CSRTI-Mysuru also conducts sericulture training programmes for international students/personnel through various organizations such as JICA and Ministry of External Affairs: Govt. of India (ITEC). The training hub houses well-equipped classrooms and the programmes are managed by qualified faculty. The attached hostels can accommodate about 125 persons.

Infrastructure Facilities

- Well-equipped laboratories, mulberry gardens and rearing houses to carry out advanced research
- Large scale rearing houses for technology validation and farmers' training
- Model Chawki Rearing Centre (CRC) to promote the concept of CRC
- Engineering Division with excellent facilities to support designing, development and fabrication of machines / equipments
- Video Conference Studio @ CSRTI, Mysuru ensures faster communication and efficient transfer of technology for effective interactions with nested units, DOSs and other organizations
- Computer center provides internet connectivity to all through LAN with print/file share support
- Bioinformatics Center (NBN Sub-DIC: DBT) provides database retrieval services
- Library Services (10763 books; 6962 bound volumes of scientific journals; 80 journals; dissertations- 292; theses-26; technical reports and CD-ROM database-AGRIS, BIOSIS, BIOTECHNOLOGY CITATION INDEX, EKASWA)

अनुसंधान प्रशिक्षण एवं विस्तार कार्यकलापों के मुख्यांश

शहतूत फसल विकास, उत्पादन एवं संरक्षण

- अंतिम उपज मूल्यांकन हेतु 4 शहतूत संकरों [सं. 6, 12, 4 व 10] को पहचाना गया जिसने वी 1 (मानक) से 15% अधिक उपज दी ।
- मूल विगलन रोग ग्रस्त प्रतिदर्शों से पंचानबे फूँदी पृथकों को डी एन ए मानचित्रण और रोगजनकता परीक्षणों के ज़रिए अभिलक्षण किया गया और पहचाने गए अति विषाक्त प्रभेद को मूल विगलन रोग प्रतिरोध क्षमता के लिए शहतूत प्राप्ति का चयन करने हेतु उपयोग किया जा रहा है ।
- शहतूत के लिए डी यू एस दिशानिर्देशों को विकसित करने हेतु 16 उपजातियों में 57 लक्षणों के लिए दो फसल आँकड़े दर्ज किए गए ।
- मूल विगलन रोग और मूल गांठ रोग प्रतिरोधी शहतूत उपजातियाँ विकसित करने हेतु संतति पंक्ति परीक्षण के अंतर्गत कृत्रिम संरोप के ज़रिए 550 संकर पादपों (14 संकरों की संकर संतति) का चयन किया गया ।
- प्रभावी रोग प्रबंधन हेतु 22 शहतूत रोगों के लिए आँकड़ा संचय-शहतूत रोग इन्फो, जो सिंगिल विन्डो संसाधन है विकसित किया गया ।
- अखिल भारतीय शहतूत समन्वित प्रयोग कार्यक्रम - तीन परीक्षण उपजातियों (जी 4 सी-2038, सुवर्णा-2) एवं दो मानकों (विशाला एवं वी-1) के लिए चार फसलों का उपज आँकड़ा दर्ज किया गया ।
- उपजातियों को लोकप्रिय बनाने तथा क्षेत्र में लगभग 300 एकड़ों में पौध रोपण करने हेतु नई शहतूत उपजातियों के लिए बीज बागान, चॉकी कीटपालन हेतु जी-2 (16 एकड़) और वयस्क कीटपालन हेतु जी4 (17 एकड़) की स्थापना की ।

रेशमकीट फसल सुधार, उत्पादन एवं संरक्षण

- द्विप्रज एकल संकर, सी एस आर 16 x सी एस आर 17 का 5.17 लाख रोग मुक्त बीज चकर्तों के साथ मूल्यांकन किया गया जिसमें दक्षिण राज्यों के 2132 किसान शामिल थे और औसतन 64.30 कि ग्रा/100 रोग मुक्त बीज चकर्तों की उपज रिकार्ड की गई । चयनित क्षेत्रों में इस संकर को और अधिक लोकप्रिय बनाने का प्रस्ताव है ।
- तीन उत्पादक द्विप्रज संकर यथा, एस 8 x सी एस आर 16, एस एस बी एस 5 x एस एस बी एस 6 (एकल संकर) तथा एफ सी 3 x सी एस आर 17 (त्रिपथ) विकसित किए गए ।
- बी एम एनओ एक्स प्रोटीन का उपयोग करते हुए चिह्नकों के सहारे चयन कार्यक्रम के माध्यम से दो बी एम एन पी वी सहनशील द्विप्रज संकर, 21 x 35 (एकल) और 21 x 118 x 62 x 87 (युग्म) विकसित किए गए ।
- एस एस आर चिह्नकों (एल एफ एल 0329 और एल एफ एल 1123) का उपयोग करते हुए चार ताप सहनशील रेशमकीट वंश विकसित किए गए ।
- उच्च तापमान और बी एम एन पी वी सहनशील चार बहुप्रज वंशों का चयन किया गया और ये एफ 10 पीडी के हैं।
- कोसा रंग और आकार की एकरूपता के लिए, अतिजीविता (रोग प्रतिरोध/सहनशीलता) उत्पादकता और उपरति में कमी तथा त्रिनिर्मोकी व्यवहार हेतु एल 14, बहुप्रज रेशमकीट नरल का सुधार किया गया। उन्नत वंशों के साथ संकर के क्षेत्र परीक्षण ने 63 कि.ग्रा./100 रो मु बी च के कोसा उपज को दर्शाया ।
- उन्नत एल 14 वंशों और नए द्विप्रज नर घटकों का उपयोग करते हुए संकर मूल्यांकन परीक्षण के माध्यम से कावेरी गोल्ड (1.14 xएस8), एक उन्नत संकर को विकसित किया गया ।
- नोसेमा बोम्बिसिस के एम ई टी ए पी2 जीन का फुमागिलिन द्वारा निषेध देखा गया और रेशमकीट में पेब्रिन संक्रमण के नियंत्रण हेतु उपयोग किया जा सकता है ।
- सेरि डीआईएस-बीज और वाणिज्यिक फसलों में रेशमकीट रोगों के अनुवीक्षण और आंकड़े संग्रहण हेतु वेब पृष्ठ को विकसित किया गया और दक्षिणी राज्यों तथा महाराष्ट्र में कार्यक्रम संचालित किया जा रहा है ।
- जैव नियंत्रण एजेंट : निसोलिन्स थैमस (411 लाख) और लेडिबर्ड भ्रमरों (1.25 लाख) का उत्पादन और आपूर्ति ।
- चॉकी कीटपालन केंद्रों और किसानों के लाभ के लिए कीटपालन ट्रे की अच्छी सफाई और विसंक्रमण हेतु ट्रे सफाई सह विसंक्रमण मशीन को विकसित किया गया ।

- जैव प्रौद्योगिकी माध्यम द्वारा शहतूत और रेशमकीट के सुधार के लिए नेटवर्क कार्यक्रम को विकसित करने हेतु डी बी टी द्वारा प्रायोजित विचारावेश सत्र (31.10.2014) का आयोजन किया गया ।

विस्तार

- आंध्रप्रदेश, कर्नाटक, केरल, तमिलनाडु, तेलंगाना और महाराष्ट्र में 106 समूहों में 2241 मी ट द्विप्रज कच्चा रेशम (देश के कुल कच्चा रेशम उत्पादन का लगभग 60%) उत्पादित किया गया । कुल 213.6 लाख रोगमुक्त बीज चकत्तों का कीटपालन कर औसतन 68.2 कि ग्रा/100 रो मु बी च प्राप्त हुए । समूहों के 14505 किसानों ने 20174 एकड़ में शहतूत कृषि को बढ़ाया ।
- आंध्र प्रदेश, कर्नाटक, तमिल नाडु, तेलंगाना और महाराष्ट्र के 11 स्थानों में ग्राम संबद्ध कार्यक्रम संस्थान (सेरि मॉडल ग्राम) को पुनः प्रारंभ किया गया । कें रे बो और रेशमउत्पादन विभाग के विस्तारण पदधारियों के सर्वेक्षण में विद्यमान किसानों के साथ दस महत्वपूर्ण प्रौद्योगिकी मध्यस्थता की गई । किसानों ने कुल 3.59 लाख रो मु बी चकते द्विप्रज संकरों का कीटपालन किया और बेंचमार्क की अपेक्षा कोसा उपज में 8.5% सुधार तथा 62.3 कि ग्रा/100 रो मु बी च की औसतन उपज रिकार्ड की गई ।
- बीदर में दिनांक 28 जनवरी 2015 को रेशम उत्पादन किसान कार्यशाला का आयोजन किया गया जिसमें नई प्रौद्योगिकियाँ और उत्पाद प्रदर्शित किए गए जिसके अंतर्गत शहतूत उपजाति जी2; रेशमकीट युग्म संकर, जी 11x जी 19, ट्रे सफाई सह विसंक्रमण मशीन, अद्यतन प्रौद्योगिकी पुस्तिका और नई प्रौद्योगिकियों पर चौपत्रे विमोचित किए गए। उत्तर कर्नाटक और तेलंगाना तथा महाराष्ट्र के आस पास के राज्यों के 1863 किसान इस कार्यशाला से लाभान्वित हुए ।
- मॉडल चॉकी कीटपालन केंद्र के माध्यम से कुल 83,900 रो मु बी च का चॉकी कीटपालन किया गया और 65 ग्रामों के 194 किसानों को आपूर्तित किया गया । औसतन उपज 67.4 से 81.5 कि ग्रा/100 रो मु बी च था ।
- 830 विस्तारण संचार कार्यक्रमों के माध्यम से शहतूत कृषि, रेशमकीट पालन, और फसल संरक्षण में नई प्रौद्योगिकियों से 41220 रेशम उत्पादक प्रभावित हुए ।
- कोसा उत्पादकों के लिए राष्ट्रीय अनुसंधान विकास निगम; भारत सरकार द्वारा प्रायोजित उद्यम विकास कार्यक्रम आयोजित किया गया ।

एकस्व एवं वाणिज्यीकरण

- छः एकस्व आवेदनपत्रों (प्यूपा चूर्ण की तैयारी, कोर्डिसेप्स का संवर्धन, अंडरिक्त रेशमकीट शलभों का उपयोग, मानव के आहार के लिए प्यूपा, प्यूपा तेल और रेशमकीट चूर्ण बनाना) को समाशोधन हेतु राष्ट्रीय जैव विविधता प्राधिकारी को प्रस्तुत किया गया ।
- आठ प्रौद्योगिकियाँ यथा पोषण, नवीन्या, अंकुश, संपूर्णा, पीवीसी चॉकी स्टैंड, कोसा कर्तित्र (हार्वेस्टर), चॉकी पत्ती कर्तित्र, हस्तचालित रेशमकीट पृथककारक को रा.अ.वि.नि. के माध्यम से आठ फर्मों के साथ वाणिज्यीकृत किया गया ।
- सम्यक तकनीकी मूल्यांकन करने के बाद, वाणिज्यिक उपयोग के लिए समृद्धि, सेरिमोर, सैनिटेक सूपर के विनिर्माताओं के साथ समझौता ज्ञापन में हस्ताक्षर किए गए ।
- उत्पादों / प्रौद्योगिकी का मान्यकरण करने के क्रम में सेरि स्वच्छ और सेरिफिट के लिए विनिर्माताओं के साथ परामर्शी परियोजनाएँ प्रारंभ की गई ।

मानव संसाधन विकास

- वस्त्र मंत्रालय, भारत सरकार की एकीकृत कुशलता विकास योजना (ए कु वि यो) के अंतर्गत 26 बैचों में कुल 499 लाभार्थियों को कोसा हस्तशिल्प, शहतूत कृषि एवं बीज गुणन, गुणात्मक द्विप्रज कोसा उत्पादन, वाणिज्यिक चॉकी कीटपालन और शहतूत एवं रेशमकीट रोग तथा पीड़क प्रबंध पर प्रशिक्षित किया गया ।
- चॉकी कीटपालन केंद्र कार्यकलापों में संरचित एवं आवश्यकता आधारित कार्यक्रमों के अंतर्गत 51 उद्यमियों / चॉकी कीटपालन केंद्र मालिकों (3 महीने) और 76 उद्यमियों (एक महीना) को सम्मिलित करते हुए कुल 751 व्यक्तियों को प्रशिक्षित किया गया ।
- आंध्र प्रदेश, तमिलनाडु एवं कर्नाटक में कार्यरत तीन जापान समुद्रपार सहकारी स्वयंसेवकों के लिए रेशम उत्पादन अभिविन्यास प्रशिक्षण कार्यक्रम (एक माह का) आयोजित किया गया ।

- बंगलादेश, फिलिप्पाइन्स, उगांडा, थाइलैंड एवं ईजिप्ट के 14 प्रशिक्षार्थियों के लिए आईटीईसी (भारतीय तकनीकी एवं आर्थिक सहकारी कार्यक्रम), विदेश मंत्रालय, भारत सरकार द्वारा प्रायोजित रेशम उत्पादन एवं रेशम उद्योग पर विशेष प्रशिक्षण कार्यक्रम (छः सप्ताह का) प्रारंभ किया गया ।

क्षेत्रीय रेशम उत्पादन अनुसंधान केंद्रों की उपलब्धियाँ निम्नलिखित हैं :

क्षेत्र अ के, अनंतपुर

- द्विप्रज कच्चा रेशम उत्पादन कार्यक्रम
समूह संवर्धन कार्यक्रम : 17,117 कृषकों ने द्विप्रज संकरों के 48.89 लाख रो मु बी चकत्तों का पालन किया और 65.4 कि.ग्रा./100 रो मु बी चकत्तों की औसतन उपज दर्ज की गई ; सं ग्रा सं का : 152 कृषकों ने द्विप्रज संकरों की 26,650 रो मु बी चकत्तों का पालन किया और 56.8 कि ग्रा/ 100 रो मु बी चकत्तों की औसतन उपज दर्ज की गई और बेंचमार्क की तुलना में 8.34% वृद्धि दर्ज की ।
- प्रौद्योगिकी स्थानांतरण कार्यक्रम :
509 कृषकों के साथ सी एस आर 16 x सी एस आर 17 की 1.43 लाख रो मु बी चकत्तों का मूल्यांकन किया गया और 64.04 कि.ग्रा. / 100 रो मु बी चकत्तों की औसतन कोसा उपज प्राप्त हुई । जैव नियंत्रण कारक, एन.थाइमस (1119 थैलियाँ/539 कृषक/31 गाँव) को आपूर्ति कर ऊजी प्रकोप को 25-40% से < 4% तक सीमित किया गया । नई शहतूत उपजातियों का पौध रोपण (1977.6 एकड़/1264 कृषक); 337 प्रतिदर्शों के लिए मृदा परीक्षण/विश्लेषण संचालित किया गया और मृदा संशोधन उपायों की सिफारिश की गई । आई एन एम, पोषण, नाविन्या, आई पी एम, व कंपोस्टिंग (525 किसान) पर प्रौद्योगिकी स्थानांतरण कार्यक्रम आयोजित किया गया ।
- विस्तारण संचार कार्यक्रम
मडकशिरा (800 किसान) और वारंगाल (600 किसान) में रेशम उत्पादन कृषक कार्यशाला संचालित की गई । 240 विस्तारण संचार कार्यक्रमों के माध्यम से कुल 1700 कृषक प्रभावित हुए ।
- प्रशिक्षण कार्यक्रम
प्रौद्योगिकी उन्नयन कार्यक्रम के अंतर्गत 82 बैचों में 1230 कृषकों तथा ए कु वि यो के अंतर्गत 108 व्यक्तियों को प्रशिक्षित किया गया ।

क्षेत्र अ के, चामराजनगर

- अनुसंधान एवं विकास परियोजनाएँ
शहतूत पौधरोपण में लाक उत्पादन की व्यवहार्यता पर अध्ययन करने हेतु आय वृद्धि के लिए सेरि लाक संवर्धन नमूना विकसित करने का कार्य किया गया । पहले फसल परिणाम से साबित हुआ है कि 200-250 कि.ग्रा. लाक/एकड़/वर्ष उत्पादित किया जा सकता है जिससे रु. 60,000 - 75,000 का अतिरिक्त आय प्राप्त हो सकता है ।
सूक्ष्म सिंचाई प्रौद्योगिकी, जिसका खर्च वहन कर सकते हैं, से सिंचित वृक्ष शहतूत कृषि (8' x 8') ने झाड़ी पौधरोपण (2380 कि.ग्रा./एकड़) की तुलना में शहतूत पत्ती उपज में 3060 कि.ग्रा./एकड़ वृद्धि दर्शाई । वर्षाश्रित स्थिति के अधीन इ पाडीनुमा कृषि (रु. 25,000/-) की तुलना में रु.1,16,000/-एकड़/वर्ष तक की आय वृद्धि हुई ।
- प्रौद्योगिकी स्थानांतरण कार्यक्रम
जैव नियंत्रण कारक, एन. थाइमस (68 कृषक) की आपूर्ति करते हुए ऊजी प्रकोप को 10.06% से 4.14% तक सीमित किया गया । एस.कोक्सिवोरा भ्रमर उत्पादित कर आपूर्ति करने पर टुकरा मीलीबग प्रकोप में 20% से 7.42% तक कमी हुई ।
- प्रशिक्षण कार्यक्रम
प्रौद्योगिकी उन्नयन कार्यक्रम के अंतर्गत 12 बैचों में 180 कृषकों और ए.कु.वि.यो. के अंतर्गत 59 व्यक्तियों को प्रशिक्षित किया गया ।

क्षेत्र अ के, कोडति

- द्विप्रज कच्चा रेशम उत्पादन कार्यक्रम
ससंका: 36 समूहों में द्विप्रज संकरों की 77.29 लाख रो मु बी चकत्तों का पालन किया गया और 66.41कि.ग्रा./100 रो मु बी चकत्तों की औसतन उपज दर्ज की गई। सं ग्रा सं का: द्विप्रज संकरों की 38800 रो मु बी चकत्तों का पालन किया गया

और 61.23 कि ग्रा/100 रो मु बी च की औसतन उपज दर्ज की गई और बेंचमार्क की तुलना में 12.79% वृद्धि रिकार्ड की गई।

- प्रौद्योगिकी कार्यक्रमों का स्थानांतरण
145 कृषकों के साथ सी एस आर 16x सी एस आर 17 की 36750 रो मु बी चकत्तों का मूल्यांकन किया गया और 61.53 कि ग्रा /100 रो मु बी चकत्तों की औसतन उपज प्राप्त हुई । 6934 कृषकों के साथ 10133.6 एकड़ में नया शहतूत पौध रोपण किया गया । 214 प्रतिदर्शों के लिए मृदा परीक्षण/विश्लेषण संचालित किया गया और मृदा संशोधन उपायों की सिफारिश की गई । ए पो प्र, पोषण, टुकरा, नवीन्या, ए पी प्र एवं वानस्पतिक खाद (344 कृषक) पर प्रौद्योगिकी स्थानांतरण कार्यक्रम संचालित किया गया ।
- विस्तारण संचार कार्यक्रम
244 विस्तारण संचार कार्यक्रमों के संचालन से 9590 कृषक प्रभावित हुए ।
- प्रशिक्षण कार्यक्रम
प्रौद्योगिकी उन्नयन कार्यक्रम के अंतर्गत 48 बैचों में 765 कृषकों एवं ए कु वि यो के अंतर्गत 81 व्यक्तियों को प्रशिक्षित किया गया ।

क्षे रे अ के, सेलम

- अनुसंधान एवं विकास परियोजनाएँ
कर्नाटक और तमिलनाडु के कृषकों के बागानों से एकत्रित थ्रिप्स के प्राकृतिक शत्रुओं को पहचानने हेतु राष्ट्रीय कृषि उपयोगी कीट ब्यूरो (एन बी ए आई आई) को दिया गया ।
- द्विप्रज कच्चा रेशम उत्पादन कार्यक्रम
स सं का: तमिलनाडु और केरल के 28 समूहों में द्विप्रज संकरों के 60.36 लाख रो मु बी चकत्तों का पालन किया गया और देश में सर्वोच्च कोसा उपज दर्ज की गई (75.4 कि ग्रा /100 रो मु बी च); सं ग्रा सं का; 200 कृषकों के साथ द्विप्रज संकरों की 1,17,487 रो मु बीज चकत्तों का पालन किया गया और 71.1 कि ग्रा/100 रो मु बी चकत्तों की औसतन उपज और 12.9% वृद्धि दर्ज की गई ।
- प्रौद्योगिकी कार्यक्रम का स्थानांतरण
केंद्र परीक्षण ने कोसा उपज और उन्नत रेशम गुणवत्ता के संबंध में मानक संकरों की तुलना में नया आई सी बी (एन डी वी-6 x सी एस आर 51), एकल संकर (डी2 x डी13) और द्वि संकर (डी एच 3) की श्रेष्ठता दर्शाई । नया उत्पादक द्विप्रज संकर (एस8 x सी एस आर6) और एन पी वी सहनशील संकर (एम ए एस एन 4 x सी एस आर 2) के क्षेत्र परीक्षण ने क्रमशः 82 कि.ग्रा. और 65.2 कि.ग्रा./100 रो मु बी चकत्तों की औसतन उपज दर्ज की । बहु गुणन एवं *एसिरोफैगस पपाये* की आपूर्ति द्वारा पपाया मीलीबग प्रबंधन (486 यूनिट या 121500 संख्या) किया गया । 43 गाँवों में लगभग 20 क्षेत्र समस्याओं का हल निकाला गया, जैव नियंत्रण कारकों का बहु गुणन; टुकरा नियंत्रण हेतु *क्रिप्टोलीमस* (48 यूनिट); और *साइमस* (108 यूनिट) पत्ती वेब्लर नियंत्रित करने हेतु *ट्राइकोग्रामा* (157 सी सी) एवं *ब्रकॉन* (245 पॉकेट) और थ्रिप्स के लिए *क्रिसोपेरिया* (66,000 संख्या) उत्पादित कर आपूर्ति किया गया । कीटपालन गृहों में ऊर्जी मक्खी प्रबंधन हेतु एन.थाइमस (222 थैली) डाले गए । 480 प्रतिदर्शों के लिए मृदा परीक्षण /विश्लेषण किया गया और मृदा संशोधन उपायों की सिफारिश की गई, एकीकृत पोषण प्रबंधन, पोषण, नवीन्या, एकीकृत पीडक प्रबंधन और कंपोस्टिंग (443 किसान) पर प्रौद्योगिकी स्थानांतरण कार्यक्रम आयोजित किए गए ।
- विस्तारण संचार कार्यक्रम
विरुद्ध नगर में रेशम उत्पादन कृषक कार्यशाला (750 कृषक) और सेलम में द्विप्रज कार्यशाला (250 कृषक) आयोजित किए गए तथा 240 वि सं का संचालित कर 13066 कृषकों को प्रभावित किया गया ।
- प्रशिक्षण कार्यक्रम
प्रौद्योगिकी उन्नयन कार्यक्रम के अंतर्गत 93 बैचों में 1394 कृषक और एकीकृत कुशलता विकास योजना के अंतर्गत 92 व्यक्तियों को प्रशिक्षित किया गया ।
- पेरियार विश्वविद्यालय, सेलम के अधीन वनस्पति विज्ञान और रेशम उत्पादन में उच्च अध्ययन हेतु 9 पी एच डी छात्र पंजीकृत किए गए ।

HIGHLIGHTS OF RESEARCH, TRAINING AND EXTENSION ACTIVITIES

MULBERRY CROP IMPROVEMENT, PRODUCTION AND PROTECTION

- Four mulberry hybrids [No. 6, 12, 4 & 10] identified for final yield evaluation, which out-yielded the V1 [check] variety by over 15%
- Ninety-five fungal isolates from root rot infected samples were characterized through DNA profiling and Pathogenicity tests and the most virulent strain identified is being utilized for screening the mulberry accessions for resistance to root rot
- Two crop data for 57 characters in 16 varieties were recorded for the development of DUS guidelines for mulberry
- 550 hybrid seedlings (hybrid progeny of 14 crosses) were short-listed through artificial inoculation under progeny row trial for developing mulberry varieties resistant to root rot and root knot
- *Mulberry disease info* – a database for 22 mulberry diseases, which is a single window resource for effective disease management was developed
- All India Co-ordinated Experiment on Mulberry (AICEM) programme - yield data of four crops has been recorded for three test varieties (G4, C-2038, Suvarna-2) and two checks (Vishala & V1)
- Seed gardens for new mulberry varieties, G2 for chawki rearing (16 acres) and G4 for late age rearing (17 acres) were established to popularize the varieties and to take up plantation in about 300 acres in the field

SILKWORM CROP IMPROVEMENT, PRODUCTION AND PROTECTION

- Bivoltine single hybrid, CSR16 x CSR17 was evaluated with 5.17 lakh dfls covering 2132 farmers of southern states and an average yield of 64.30 kg/100 dfls was recorded. The hybrid is proposed for further popularization in selected areas
- Three productive bivoltine hybrids viz., S8 x CSR16, SSBS 5 x SSBS 6 (single hybrids) and FC3 x CSR17 (three-way cross) were developed
- Two BmNPV tolerant bivoltine hybrids, 21 x 35 (single) and 21x118 X 62x87 (double) were developed through marker assisted selection programme utilizing BmNOX protein
- Four thermo-tolerant silkworm lines were developed utilizing SSR markers (LFL0329 & LFL1123) associated with thermo-tolerance
- Four polyvoltine lines tolerant to high temperature and BmNPV were short-listed and are currently at F10 generation
- L14, polyvoltine silkworm breed producing international grade silk was improved for cocoon colour, size uniformity, survival (disease resistance/tolerance), productivity and reduction in diapause and trimoulter behaviour. The field trial of hybrid with improved lines recorded cocoon yields up to 63kg/100 dfls
- Cauvery Gold (L14 x S8), an improved crossbreed was developed through hybrid evaluation tests utilizing improved L14 lines and new bivoltine male components
- The expression of MetAP2 gene of *Nosema bombycis* was observed to be inhibited by Fumagillin and could be utilized for therapeutic control of pebrine infection in silkworm
- SERI DIS – web page for the data collection and monitoring of silkworm diseases in seed and commercial crops was developed and the programme is being conducted in Southern States and Maharashtra
- Production and supply of biocontrol agents: *Nesolynx thymus* (411 lakhs) and ladybird beetles (1.46 lakhs)

- Tray washing cum disinfection machine was developed for efficient rearing tray washing and disinfection for the benefit of chawki rearing centers and farmers
- DBT sponsored Brainstorming session was organized (31.10.14) for developing network programmes for improvement of mulberry and silkworm through biotechnological approaches

EXTENSION

- 2241 MT bivoltine raw silk (about 60% of total raw silk production in the country) was produced in 106 clusters in Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Telangana, Maharashtra and Madhya Pradesh. A total of 213.6 lakh dfls were reared with an average yield of 68.2 kg /100 dfls. Mulberry plantation was expanded by 20174 acres with 14505 farmers in clusters
- Institute Village Linkage Programme (Seri Model Village) was re-initiated at 11 locations in Andhra Pradesh, Karnataka, Tamil Nadu, Telangana, Maharashtra and Madhya Pradesh. Ten important technology interventions were made with the existing farmers under close supervision of extension officials from CSB and DOS. A total 3.59 lakh dfls of bivoltine hybrids were reared with farmers and 8.5% improvement in cocoon yield against the bench mark with an average yield of 62.3 kg/100 dfls was recorded
- Sericulture farmers' workshop was organized at Bidar (28th Jan 2015), in which new technologies and products were exhibited including release of mulberry variety, G2; silkworm double hybrid, G11 x G19; Tray washing cum disinfection machine; latest technology booklet; and pamphlets on new technologies. 1863 farmers from Northern Karnataka and adjoining states of Telangana and Maharashtra benefited from the workshop
- A total of 83,900 dfls were chawki reared (32 batches) and supplied to 194 farmers covering 65 villages through model CRC and the average yields ranged 67.4 - 81.5 kg/100 dfls
- 41220 sericulturists were sensitized for new technologies in mulberry cultivation, silkworm rearing and crop protection through 830 Extension Communication Programmes
- An entrepreneurial development programme sponsored by NRDC (National Research Development Corporation: Govt. of India) was initiated for the production and supply of cocoon harvesters developed by the institute

PATENTS AND COMMERCIALISATION

- Six patent applications (preparation of pupae powder, culturing of *Cordyceps*, use of spent silkworm moths, pupae for human food, preparation of pupae oil and preparation of silkworm powder) were submitted to National Biodiversity Authority for clearance
- Eight technologies viz., Poshan, Navinya, Ankush, Sampurna, PVC chawki stand, cocoon harvester, chawki leaf chopper, hand operated silkworm separator were commercialized through NRDC with eight firms
- MOUs entered with the manufacturers of Samruddhi, Serimore, Sanitech Super for the commercial utilization after thorough technical evaluation
- Consultancy projects for validating the products/technology were initiated for SERI SWACCH and SERI FIT with manufacturers

HUMAN RESOURCE DEVELOPMENT

- 499 beneficiaries trained in 26 batches on Cocoon Handicrafts, Mulberry Cultivation and Seed Multiplication, Quality Bivoltine Cocoon Production, Commercial Chawki Rearing and Mulberry & Silkworm Diseases and Pest Management under Integrated Skill Development Scheme (ISDS), Ministry of Textiles, Govt. of India

- A total of 751 persons trained under structured and need based programmes including 51 entrepreneurs/CRC owners (3 months) and 76 entrepreneurs (one month) in CRC activities
- Orientation training programme in sericulture (one month) was organized for three Japan Overseas Cooperation volunteers (JOCV) working in Andhra Pradesh, Tamil Nadu and Karnataka
- Special training programme (six weeks) on Sericulture and Silk Industry sponsored by ITEC (Indian Technical & Economic Cooperation Programme), Ministry of External Affairs, Govt. of India was initiated with 14 trainees from Bangladesh, Philippines, Uganda, Thailand and Egypt

ACHIEVEMENTS OF REGIONAL RESEARCH STATIONS (RSRS's)

RSRS, ANANTAPUR

- Bivoltine Raw Silk Production Programmes
CPP: 48.89 lakh dfls of bivoltine hybrids were reared with 17,117 farmers and the average yield recorded was 65.4 kg/100 dfls; IVLP: 26,650 dfls of bivoltine hybrids were reared with 152 farmers and the average yield recorded was 56.8 kg/100 dfls and recorded an improvement of 8.34% against benchmark
- Transfer of Technology Programmes
1.43 lakh dfls of CSR16 x CSR17 were evaluated with 509 farmers and obtained an average cocoon yield of 64.04 kg /100 dfls; Uzi infestation was limited to < 4% from 25-40% by supplying the biocontrol agent, *N. thymus* (1119 sachets/539 farmers/31 villages); Plantation of new mulberry varieties (1977.6 acres/1264 farmers); Soil testing/analysis was conducted for 337 samples and soil correction measures were recommended; TOT programmes were also conducted on INM, Poshan, Navinya, IPM & composting (525 farmers)
- Extension Communication Programmes
Sericulture Farmers Workshops were conducted at Madakasira (800 farmers) and Warangal (600 farmers); 240 ECPs were conducted sensitizing 1700 farmers
- Training Programmes
1230 farmers were trained in 82 batches under TUP and 108 persons under ISDS

RSRS, CHAMARAJANAGAR

- R&D Projects
Seri-Lac culture model for income augmentation was carried out to assess the feasibility of lac production in mulberry plantation. First crop results indicate 200-250 Kg lac/acre/year could be produced resulting in realizing an additional income of Rs.60000 – 75000
Tree mulberry cultivation (8'x8') irrigated with Affordable Micro-Irrigation Technology (AMIT) resulted in an increase in mulberry leaf yield, 3060 kg/acre as compared to bush plantation (2380 kg/acre). The income augmentation was upto Rs.116000/acre/year as against Rs.25000 under rainfed condition with bush plantation
- Transfer of Technology Programmes
Uzi infestation was limited to 4.14% from 10.06% by supplying the biocontrol agent, *N. thymus* (68 farmers); Reduction of tukra mealy bug infestation from 20% to 7.42% was achieved through *S. coccivora* beetle production and supply (77 boxes/ 54.5 acres)
- Training Programmes
180 farmers were trained in 12 batches under TUP and 59 persons under ISDS

RSRS, KODATHI

- Bivoltine Raw Silk Production Programmes
CPP: 77.29 lakh dfls of bivoltine hybrids were reared in 36 clusters and the average yield recorded was 66.41 kg/100 dfls; IVLP: 38800 dfls of bivoltine hybrids were reared and the average yield recorded was 61.23 kg/100 dfls and recorded an improvement of 12.79% against benchmark
- Transfer of Technology Programmes
36750 dfls of CSR16 x CSR17 were evaluated with 145 farmers and obtained an average cocoon yield of 61.53 kg/100 dfls; New mulberry plantation was taken up in 10133.6 acres with 6934 farmers; Soil testing/analysis was conducted for 214 samples and soil correction measures were recommended; TOT programmes were also conducted on INM, Poshan, Tukra, Navinya, IPM & composting (344 farmers)
- Extension Communication Programmes
244 ECPs were conducted sensitizing 9590 farmers
- Training Programmes
765 farmers were trained in 48 batches under TUP and 81 persons under ISDS

RSRS SALEM

- R&D Projects
Natural enemies of thrips collected from farmers' gardens of Karnataka and Tamil Nadu were deposited with NBAIL for identification
- Bivoltine Raw Silk Production Programmes
CPP: 60.36 lakh dfls of bivoltine hybrids were reared in 28 clusters in Tamil Nadu and Kerala and recorded highest cocoon yields (75.4 kg/100 dfls) in the country; IVLP: 1,17,487 dfls of bivoltine hybrids were reared with 200 farmers and the average yield recorded was 71.1 kg/100 dfls and recorded an improvement of 12.9%.
- Transfer of Technology Programmes
OST revealed the superiority of new ICB (NDV6 x CSR51), single hybrid (D2 x D13) and double hybrid (DH3) over the control hybrids with regard to cocoon yield and improved silk quality; OFT of new productive bivoltine hybrid (S8 x CSR6) and NPV tolerant hybrid (MASN4 x CSR2) recorded an average yield of 82 kg and 65.2 kg/100 dfls, respectively; Papaya mealy bug management was undertaken (486 units or 121500 nos.) by mass multiplication and supply of *Acerophagus papayae*; About 20 field problems in 43 villages were resolved; Mass multiplication of biocontrol agents: *Cryptolaemus* (48 units) and *Scymnus* (108 units) to control tukra; *Trichogramma* (157 cc) and Bracon (245 pockets) to manage leaf webber and *Chrysoperla* (66000 nos) for thrips were produced and supplied; Released *N. thymus* (222 pouches) for Uzifly management in rearing houses; Soil testing/analysis was conducted for 480 samples and soil correction measures were recommended; TOT programmes were also conducted on INM, Poshan, Navinya, IPM & composting (443 farmers)
- Extension Communication Programmes
Sericulture Farmers Workshops were conducted at Virudhnagar (750 farmers) and bivoltine workshop at Salem (250 farmers); 240 ECPs were conducted sensitizing 13066 farmers
- Training Programmes
1394 farmers were trained in 93 batches under TUP and 92 persons under ISDS
- Nine PhD students are registered for higher studies in Botany and Sericulture under Periyar University, Salem

राजभाषा कार्यान्वयन संबंधी गतिविधियाँ

केंद्रीय रेशम उत्पादन अनुसंधान एवं प्रशिक्षण संस्थान, मैसूर में वर्ष 2014-15 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 हर तिमाही में राजभाषा कार्यान्वयन समिति की बैठक का आयोजन कर राजभाषा प्रगति के बारे में समीक्षा की गई।

हिन्दी कार्यशालाओं का आयोजन, हिन्दी दिवस और पखवाड़े का आयोजन, हिन्दी पत्रिका का प्रकाशन तथा हिंदी टिप्पणी-आलेखन प्रोत्साहन योजना का कार्यान्वयन किया गया 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 कागजात 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 द्विभाषी सुनिश्चित करने हेतु जाँचबिंदु (फोटोप्रति कक्ष, भंडार अनुभाग, प्रेषण कक्ष और संबंधित अधिकारी के यहाँ) बनाए गए हैं।

3. हिन्दी पत्राचार: वर्ष के दौरान क, ख तथा ग क्षेत्र स्थित केंद्रीय सरकारी कार्यालयों को क्रमशः 91.6%, 68.4% और 59.6% तथा क व ख क्षेत्र स्थित राज्य सरकार के कार्यालयों/व्यक्तियों को 100% पत्र हिन्दी में भेज कर पत्राचार लक्ष्य से अधिक प्रतिशत प्राप्त किया है।

4. राजभाषा कार्यान्वयन समिति की बैठकों का आयोजन: संस्थान में हर तिमाही में राजभाषा कार्यान्वयन समिति की बैठक का आयोजन कर राजभाषा के प्रगामी प्रयोग के बारे में समीक्षा की गई। वर्ष 2014-15 के अंतर्गत राजभाषा कार्यान्वयन समिति की बैठकों का दिनांक 15-05-2014, 02.09.2014, 16.12.2014 एवं 13.03.2015 को आयोजन किया गया तथा बैठकों में लिए गए निर्णयों पर अनुवर्ती कार्रवाई की गई।

संस्थान के अधीनस्थ कार्यालयों के लिए भी दिनांक 31.07.2014 और 19.03.2015 को राजभाषा कार्यान्वयन समिति की बैठकें आयोजित की गईं और राजभाषा कार्यान्वयन में हुई प्रगति के बारे में समीक्षा 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 वैज्ञानिकों के लिए भी इस वर्ष के दौरान दिनांक 25.6.2014, 29.09.2014, 20.12.2014 तथा 18.3.2015 को अलग-अलग एक दिवसीय हिन्दी कार्यशाला का आयोजन कर कुल 7 अधिकारी व 38 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 20.9.2014 को आयोजित राजभाषा पखवाड़ा समापन समारोह में नकद पुरस्कार वितरित किए गए, उनके अलावा अधीनस्थ कार्यालयों के 10 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 प्रकाशन: संस्थान की वार्षिक रिपोर्ट अंशतः द्विभाषी में और प्रशिक्षण कैलेंडर द्विभाषी में प्रकाशित किए गए। संस्थान की गृह पत्रिका "रेशम किरण" (अर्ध वार्षिक) 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 दिशा में इस संस्थान के अलावा 06 अधीनस्थ कार्यालयों को अधिसूचित कराया जा चुका है।

10. हिन्दी प्रतियोगिताओं का आयोजन: संस्थान में दिनांक 1.9.2014 से 15.9.2014 तक राजभाषा पखवाड़ा मनाया गया जिस दौरान 10 विभिन्न हिन्दी प्रतियोगिताओं यथा सहीलेखन, श्रुतलेखन, स्मृति परीक्षण, सामूहिक चर्चा, वाक् प्रतियोगिता, टिप्पण-आलेखन

एवं प्रशासनिक शब्दावली, तकनीकी शब्दावली, गीत, तस्वीर क्या बोलती है ? और 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 सभी अभिकलित्रों में यूनिकोड की व्यवस्था है जिससे हिन्दी, अंग्रेजी तथा अन्य भारतीय भाषाओं में काम करने में सुविधा हुई है।

12. प्रशिक्षण: सितंबर 2014 से फरवरी 2015 तक कुल 14 पदधारियों को "कंप्यूटर पर हिंदी में काम करने के लिए बुनियादी प्रशिक्षण कार्यक्रम" में प्रशिक्षित किया गया है।

13. निरीक्षण: अधीनस्थ कार्यालयों में राजभाषा कार्यान्वयन की प्रगति की समीक्षा करने और तदनुसार आवश्यक सुझाव और मार्गदर्शन देने के लिए उनका निरीक्षण किया जाता है। रिपोर्टाधीन वर्ष में कुल 11 कार्यालयों का निरीक्षण किया गया है।

ACTIVITIES REGARDING OFFICIAL LANGUAGE IMPLEMENTATION

During 2014-15 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 by conducting quarterly meetings of the Official Language Implementation Committee (OLIC).

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

Action taken on various items of official language implementation during the period is as follows:

1. **Compliance of section 3(3):** All the papers coming under section 3(3) of the Official Languages Act 1963 have been issued in bilingual.
 2. **Compliance of Rule 11:** All types of forms, letter heads, Rubber stamps, Sign boards, Name plates, Envelopes, Identity cards, Visiting cards etc are bilingual. Check points (at Xerox cell, Stores section, Despatch section and the concerned officer) have been devised to ensure the same in bilingual.
 3. **Hindi Correspondence:** During the year the prescribed targets for correspondence of Hindi were achieved by sending 91.6%, 68.4% and 59.6% letters in Hindi to Central Govt. Offices of A, B and C regions respectively and 100% 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 was reviewed from time to time by conducting OLIC meeting in every quarter. During 2014-15, Official Language Implementation Committee meetings were organised on 15.5.2014, 02.9.2014, 16.12.2014 and 13.3.2015 and follow up action was taken on the decisions of the meeting.
- For the sub-ordinate offices also Official Language Implementation Committee meetings were organized on 31.7.2014 and 19.03.2015 and reviewed regarding implementation of Official Language.
5. **Organisation of Hindi Workshops:** Hindi workshop was organised in every quarter for the officials of the Institute to provide information on how to use Hindi in the official work and extend information about Official Language Policy. During the year, 7 officers and 38 staff have been trained in Hindi workshops organised on 25.06.2014, 29.09.2014, 20.12.2014 and 18.03.2015 separately for technical, administrative officials 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 20.09.2014. Apart from this, 10 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 have 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. **Publications in Hindi:** Annual report of the Institute was published partly in bilingual and the training calendar was published in bilingual. 'Resham Kiran' (Half yearly house journal) of this institute was published in Hindi.
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. In this direction, apart from this office, 6 subordinate offices have also been notified.
10. **Organisation of Hindi competitions:** Official Language fortnight was organised from 01.09.2014 to 15.09.2014 during which 10 different Hindi competitions viz., Correct writing, Dictation, Memory test, Group discussion, Elocution, Noting-drafting and administrative glossary, Technical glossary, Songs, What does the picture speak? and 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 was carried out smoothly on computers. Unicode system is activated in all computers which facilitates to do work in Hindi, English and other Indian languages.
12. **Training:** 14 Officials have undergone training on "Basic Training programme to work in Hindi on computers" during Sept. 2014 to February 2015.
13. **Inspection:** Sub-ordinate offices are inspected for reviewing the progress made regarding implementation of Official Language Policy and extending necessary suggestions & guidance accordingly. During the year under report 11 offices have been inspected.

MULBERRY BREEDING AND GENETICS LABORATORY

I. Concluded Research Projects

PIB 3370 : Development of superior mulberry varieties by exploitation of hybrid vigour based on molecular marker diversity of promising parental lines (Jul. 2006 to Mar. 2015)

Rajashekar, K., S. Gandhi Doss, Rekha, M., M. K. Prithvi Raje Urs, V. Girish Naik, R. Balakrishna, B. N. Susheelamma, Mala V. Rajan and S. B. Dandin

Budget: Rs. 10.82 lakhs

Objectives: Short-listing promising hybrids for Final Yield Evaluation [FYE] through identification of divergent parental lines, hybridization, screening and evaluation of hybrid progeny in Progeny Row Trial [PRT] and Primary Yield Evaluation [PYE].

Observations/Results: Fourteen elite and promising mulberry genotypes were selected as parents based on molecular diversity assessment by RAPD and ISSR analysis. Fifteen crosses were carried out among the identified parents to develop more than 20,000 hybrids based on genetic diversity. The hybrids were subjected to four-stage evaluation viz., seedling screening for vigour, progeny row trial, rooting evaluation and primary yield evaluation to identify hybrids superior to V1 in yield and growth parameters. High level of polymorphism was observed among the 14 genotypes evolved and five genotypes are cultivated by the farmers in different agro-climatic zones and the rest are being popularized for cultivation under specific conditions.

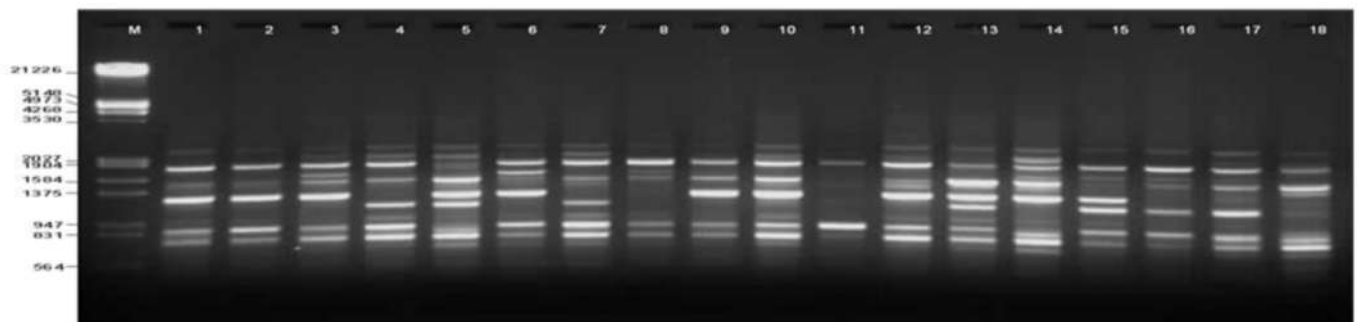
RAPD Primer	Sequence [5' – 3']	Amplified bands (Nos)	Polymorphic bands (Nos)	Polymorphism (%)
OPA-01	-caggcccttc-	17	11	64.70
OPA-04	-aatggggctg-	13	08	61.50
OPA-07	-gaaacgggtg-	18	15	83.30
OPA-09	-ggtaacgcc-	06	04	66.70
OPA-10	-gtgatcgag-	10	06	60.00
OPA-13	-cagcaccac-	14	09	64.30
OPA-14	-tctgtgctgg-	08	06	75.00
OPA-15	-ttccgaacc-	10	08	80.00
OPA-16	-agccagcgaa-	13	12	92.30
OPA-17	-gaccgctgt-	06	03	50.00
OPA-19	-caaacgtcgg-	11	10	90.90
OPC-01	-ttcgagccag-	15	11	73.30
OPC-04	-ccgcatctac-	16	13	81.30
OPC-05	-gatgaccgcc-	20	18	90.00
OPC-06	-gaacgactc-	15	14	93.30
OPC-08	-tggaccggtg-	18	10	55.60
OPC-09	-ctcaccgtcc-	12	10	83.30
OPC-10	-tgtctgggtg-	13	13	100.00
OPC-11	-aaagctgcgg-	14	12	85.70
OPC-12	-tgtcatcccc-	09	07	77.80
OPC-13	-aagcctcgtc-	11	08	72.70
OPC-14	-tgcgtgcttg-	13	11	84.60

ISSR Primer	Sequence [5' – 3']	Amplified bands (Nos)	Polymorphic bands (Nos)	Polymorphism (%)
UBC-807	-agagagagagagagt-	16	13	81.30
UBC-809	-agagagagagagagg-	15	13	86.70
UBC-810	-gagagagagagagat-	14	09	64.30
UBC-811	-gagagagagagagac-	11	07	63.60
UBC-812	-gagagagagagagaaa-	13	11	84.60
UBC-814	-ctctctctctctcta-	12	03	25.00
UBC-825	-acacacacacacact-	12	10	83.30
UBC-830	-tgtgtgtgtgtgtgg-	09	07	77.80

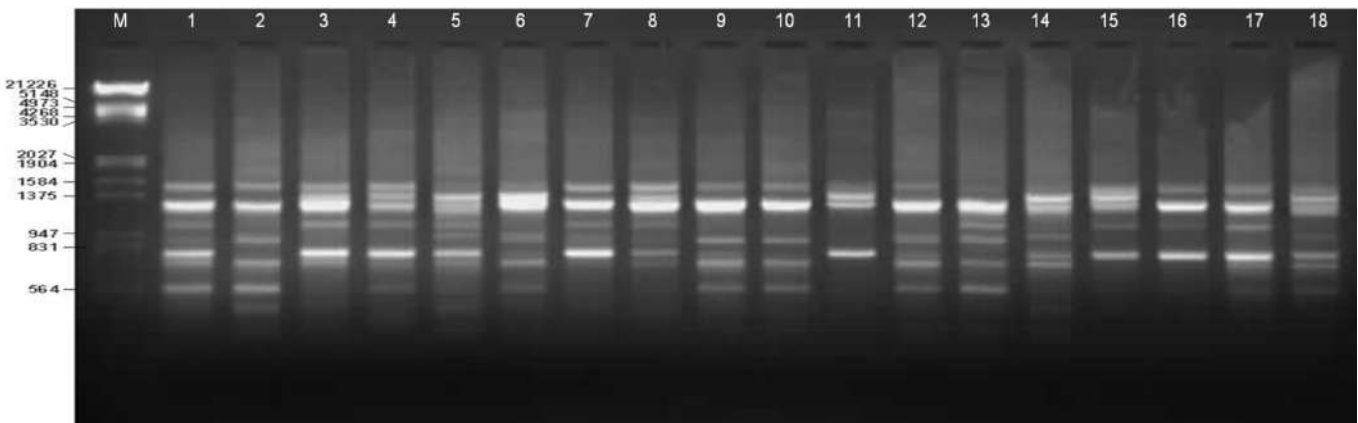
Genetic distance among elite and promising parental lines

Male \ Female	S13	S34	AR11	V1	RFS135	RFS175
G2	0.216	0.176	0.271	0.214	0.203	0.191
G4	0.250	0.209	0.293	0.236	0.257	0.256
SAHANA	0.208	0.179	0.252	0.191	0.215	0.181
RC1	0.194	0.171	0.268	0.202	0.221	0.164
RC2	0.209	0.179	0.266	0.183	0.212	0.177
S1	0.153	0.199	0.304	0.172	0.257	0.201
S36	0.160	0.196	0.272	0.150	0.247	0.168
K2	0.186	0.223	0.292	0.215	0.227	0.173

Fifteen crosses were carried out among the parents selected based on genetic diversity analysis. More than 20,000 seeds were sown in seed beds to raise the hybrid progeny. After the initial screening for vigour in the seed beds, 3000 promising hybrids were transplanted to the field for progeny row trail [PRT]. Surviving hybrids (2409) from the PRT plot were individually evaluated for length of the longest shoot [LLS], Number of shoots per plant [NS] and weight of above ground biomass [AGB]. Data on quantitative characters were also recorded for ten harvests spread over two years and analyzed. A four stage evaluation process was adapted to shortlist 54 promising hybrids.



DNA marker profiles of mulberry genotypes generated by RAPD primer OPC-04



DNA marker profiles of mulberry genotypes generated by ISSR primer UBC-830

Lines: 1(G2), 2(G4), 3(K2 x Kousen), 4(RC1), 5(Mysore Local), 6 (AR12), 7(RC2), 8(S1635), 9(S34), 10(S13), 11(AR11), 12(V1), 13(S1), 14(S36), 15(S146), 16(RFS135), 17(RFS175), 18(K2) and M (DNA EcoRI + HindIII double digest; molecular size marker in bp). The DNA marker data was utilized in estimation of genetic distance and diversity among genotypes for selection of parental combination in mulberry breeding for hybrid vigour.

In the next phase of selection, 54 hybrids short-listed in PRT were subjected to rooting evaluation. The rooting percentage ranged from 46-94% in the test hybrids. Sixteen promising hybrids with 78-94% rooting were selected for primary yield evaluation. Saplings of short-listed genotypes were raised in nursery beds and eight month-old saplings were planted in RBD with 3 replications for establishment of PYE experiment along with the check variety (V1). The PYE was conducted under assured irrigated conditions following recommended package of practices. Data on leaf yield and growth parameters for ten crops were recorded and analyzed. Four hybrids No. 4, 6, 10 and 12 out-yielded V1 variety by 11.56-19.60%. The hybrids also showed significantly higher values for number of shoots/plant and length of

the longest shoot. The leaf moisture content in four hybrids was on par with that of check variety, V1. The moisture retention capacity was found to be marginally low in hybrid No. 4, 6 and 12, while it was on par with V1 in hybrid No.10.

Inference: Crossing among distant mulberry genotypes resulted in creation of beneficial variability as evidenced by selection of over 2% of population, which recorded higher values than population mean plus standard deviation for quantitative parameters. Four hybrids that out yielded the check variety, V1 by 11.56-19.60% in the primary yield evaluation may be taken up for Final Yield Evaluation followed by authorization trials.

Information generated or technology developed or processes evolved and recommendations: Four hybrids that out yielded the check variety in the PYE may be taken up for FYE and authorization trials.

Cross	Vigorous hybrids selected for PRT (Nos)	Genetic distance
G2 x AR11	338	0.271
K2 x RFS 135	336	0.227
G4 x RFS 135	198	0.257
G4 x AR11	212	0.293
G4 x RFS 175	117	0.256
RC2 x AR11	64	0.266
RC2 x S13	39	0.209
RC1 x RFS 135	150	0.221
RC1 x AR 11	26	0.268
K2 x V1	67	0.215
SAHANA x AR11	119	0.262
G4 x S13	574	0.250
S 36 x RFS 135	532	0.247
S36 x AR11	95	0.272
RC2 x RFS135	133	0.212

Population mean and variability of quantitative traits at different stages of selection

Stage of selection	Hybrids (Nos)	Length of longest shoot [cm]			Shoots/Plant (Nos)			Wt. of above ground biomass/plant [g]		
		Mean	SD	CV %	Mean	SD	CV %	Mean	SD	CV %
I	2409	167.02	40.30	24.12	4.67	2.16	46.25	407.85	287.80	70.56
II	345	165.09	29.52	17.88	8.89	2.97	33.40	883.78	380.63	43.06
III	138	178.81	22.11	12.36	11.26	3.98	35.34	1416.88	495.67	33.90
IV	54	228.23	21.66	09.49	11.19	2.47	22.07	2440.00	430.00	17.62

Performance of short-listed hybrids in PYE

Hybrid No.	Parentage	Genetic Distance	NS (No)	LLS (cm)	ND (cm)	MC (%)	MRC %	Leaf yield (g/plant/yr)	% Variance
HV 1	G2 x AR11	0.271	12.47	149.48	5.96	78.04	75.84	3045.89	-10.95
HV 2	G2 x AR11	0.271	14.80	116.03	5.19	77.56	69.65	3338.78	-2.38
HV 3	K2 x RFS135	0.227	10.64	104.78	5.37	78.74	77.11	2322.56	-32.10
HV 4	G4 x RFS135	0.257	19.44	145.13	5.65	77.57	68.36	3933.09	14.99
HV 5	Sahana x AR11	0.252	12.80	131.97	5.81	75.37	71.27	3023.42	-11.60
HV 6	G4 x S13	0.250	14.47	140.16	5.90	76.91	70.58	3815.68	11.56
HV 7	G4 x S13	0.250	11.97	125.48	5.08	77.18	72.70	2734.02	-20.06
HV 8	G4 x S13	0.250	11.22	141.18	5.33	79.72	76.54	3058.72	-10.57
HV 9	S36 x RFS135	0.247	13.78	123.36	5.90	75.80	78.55	2917.79	-14.69
HV 10	S36 x RFS135	0.247	20.08	162.01	6.15	78.47	73.32	4090.84	19.60
HV 11	S36 x RFS135	0.247	13.26	139.79	6.28	75.30	75.52	3296.42	-03.62
HV 12	G4 x RFS135	0.257	18.13	142.47	6.13	77.64	68.84	3867.91	13.09
HV 13	G4 x RFS175	0.256	14.24	138.36	6.07	75.07	71.36	2968.03	-13.22
HV 14	G4 x RFS175	0.250	13.98	126.33	5.77	78.38	75.05	2858.85	-16.41
HV 15	RC1 x AR11	0.268	12.81	126.65	4.91	77.42	76.41	2758.30	-19.36
HV 16	G4 x S13	0.250	13.69	137.11	5.86	78.30	73.69	3344.99	-02.02
	V1 [Check]		11.55	122.91	5.50	77.80	75.34	3420.34	
	CD at 5%		0.59	6.74	0.10	ns	2.65	257.69	
	CV%		7.39	9.17	3.28	6.88	6.43	14.49	

NS: Number of shoots/plant; LLS: Length of the longest shoot; ND: Internodal distance; MC: Moisture content in leaf; MRC: Moisture retention capacity of leaves after 6 hours of harvest.

II. On-going Projects

PIB 3457 : Development of disease resistant 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)

S. Gandhi Doss, Rajashekar, K. and V. Nishitha Naik

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

Hybrid seedlings from crossing among eight female and four male germplasm accessions selected based on disease response to root rot and root knot pathogens in artificial inoculation studies were raised in seed beds. During the first stage of screening, seedlings were subjected to artificial inoculation studies with pathogens of root-rot and root

Cross	Progeny screened (Nos)	Progeny short-listed for PRT (Nos)
Punjab local x V1	520	118
Himachal local x C776	530	149
English black x V1	540	65
RC2 x V1	40	4
S36 x V1	55	20
S30 x Mysore local	75	13
Roso x V1	210	75
<i>M. multicaulis</i> x Mysore local	320	87
K2 (4n) x China white	80	27
<i>M. multicaulis</i> x C776	890	228
G2 x C776	30	15
S36 x Mysore local	100	26
S36 (4n) x Almora local	20	8
Punjab local x Mysore local	650	75
Punjab local x C776	480	18
Punjab local x Almora local	345	22

knot. More than 900 seedlings, which survived selection pressure, were nurtured in the seed beds for hardening and evaluation in Progeny Row Trial [PRT].

Conclusion

Out of 4885 hybrid seedlings raised from 16 different crosses, 950 seedlings, which survived after artificial inoculation of root-rot and root-knot pathogens in seed beds were short-listed for progeny row trial.



Other programmes of continuous/routine nature

Maintenance of mulberry germplasm, mother culture and demonstration plot

Rajashekar, K. and S. Gandhi Doss

A working germplasm with 62 accessions was maintained for carrying out hybridization programmes. Sixteen elite varieties were maintained in the demonstration plot for the benefit of sericulturists, students and other stakeholders. Breeders seed plots of three varieties- (i) G4- evolved for late age silkworm rearing, (ii) G-2 evolved for young age silkworm rearing and (iii) MSG 2 evolved for cultivation in soil moisture stress environments were planted and maintained for seed supply.

Development of doubled haploids through *in vitro* technique for mulberry improvement (April 2014 to September 2015)

S. Gandhi Doss and Rajashekar, K.

Objective: To develop doubled haploids of mulberry through gynogenesis and diploidization.

Gynogenic shoot induction was achieved in 2% of the female catkin cultures. The gynogenic shoots were sub-cultured for multiplication and rooting. Seventeen putative haploid gynogenic shoots were subjected to rhizogenesis and hardening. Four putative haploids have been planted in pots for acclimation. Ten shoot explants of putative haploids were simultaneously subjected to colchicine (0.1%) treatment in MS media for diploidization.

Conclusion: Media for *in vitro* induction of flowering, gynogenesis and rooting of gynogenic shoots have been standardized. The haploid and doubled haploid plants will be utilized in genetic studies.

All-India Coordinated Experimental Trial for Mulberry (AICEM) - PHASE-III (Jul. 2011 to Dec. 2015)

Regional Coordinator: V. Sivaprasad, Director, CSRTI, Mysuru

S. Gandhi Doss, Rajashekar, K. and Rekha, M., M. A. Shantahan Babu¹ and Sathynarayana Raju¹, M. Venkatachalapathi², B. Srinath³, S. Balasaraswathi⁴, S. Masilamani⁴, M. Noble Morrison⁵, Uma Meheswara Rao⁶, Eshwar⁷, K. Ramamoorthy⁸
¹RSRS Anantapur, ²REC Rayachoty, ³REC Vikarabad, ⁴REC Krishnagiri, ⁵REC Madivala, ⁶APSSRDI, Hindupur, ⁷KSSRDI, Thalaghattapura, ⁸TNAU, Coimbatore.

The experiment is laid out in RBD with 3 test varieties (C 2038, G 4 & Suvarna-2) along with one regional check (V1) and a National check (Vishala) with six replications. The progress of work in respect of different test centers is detailed below:

CSRTI, Mysuru: Data on leaf yield and growth parameters were recorded over eight crop seasons. Variety G 4 recorded significantly higher values for number of leaves / meter length and leaf : shoot ratio over the check varieties. The moisture content in G4 was higher [75.82%] than in V1 [74.74%], whereas C2038 recorded significantly higher values for leaf : shoot ratio [0.67] and moisture retention capacity after 6 hours of excision [73.80%] and leaf yield over the check V1. None of the test varieties yielded significantly higher over Vishala.

Performance of mulberry varieties – AICEM III Phase at CSRTI-Mysuru

Variety	DSP	TSL(cm)	NLPM	LS	MC(%)	MRC%	Leaf yield (kg/ha/ yr)
C2038	13.5	1101.25	17.30	0.67	75.46	73.80	45879
G4	14.2	919.55	20.92	0.66	75.82	69.78	40584
Suvarna 2	13.9	1167.83	17.28	0.62	76.29	70.33	39501
Vishala	12.5	1062.96	16.26	0.58	75.74	70.84	44368
V1	14.2	1054.69	19.22	0.62	74.74	74.16	36490
CD at 5%	0.95	149.61	1.07	0.01	0.74	1.91	5569
CV%	8.37	14.73	10.50	5.81	2.16	3.87	13.34

DSP: Days to sprout after pruning; TSL: Total shoot length (cm); NLPM: No. of leaves/m length; LS: Leaf : shoot ratio; MC: Leaf moisture content (%);MRC: Moisture retention capacity (%)

Performance of mulberry varieties – AICEM III Phase at other test centres

Variety	DSP	TSL(cm)	NLPM	LS	MC(%)	MRC%	Leaf yield (kg/ha/ yr)
RSRS-Anantapur							
C2038	NA	710.31	17.84	0.81	72.77	82.24	35312
G4	NA	876.01	19.84	0.73	72.75	80.25	49420
Suvarna 2	NA	787.63	19.50	0.79	71.11	81.32	40307
Vishala	NA	831.68	19.47	0.64	72.37	82.08	47982
V1	NA	913.46	19.69	0.71	72.09	83.13	46461
CD at 5%	-	53.00	0.36	0.06	NS	NS	5661
CV%	-	11.86	4.31	10.74	1.78	3.40	17.09
REC-Rayachoti							
C2038	15.0	1061.33	21.19	0.55	66.76	85.41	54390
G4	15.0	1084.85	26.75	0.58	69.73	86.82	53486
Suvarna 2	15.0	1001.52	22.02	0.58	69.60	85.51	53606
Vishala	15.0	926.54	22.42	0.52	70.04	84.30	48704
V1	15.0	939.13	29.83	0.55	68.30	84.60	44803
CD at 5%		19.77	4.94	0.01	0.55	0.83	884
CV%		6.47	20.73	4.66	1.86	1.25	7.36

REC-Vikarabad							
C2038	16.88	841.96	18.55	0.58	68.36	85.25	40475
G4	15.48	1024.19	22.64	0.61	69.08	88.58	47232
Suvarna 2	17.33	754.13	17.21	0.49	70.14	84.39	32507
Vishala	19.48	856.07	16.58	0.52	66.85	84.77	34656
V1	15.58	1162.95	19.07	0.62	69.40	89.18	45008
CD at 5%	0.91	49.25	0.54	0.02	1.85	2.92	1936
CV%	9.54	16.32	11.45	9.22	2.59	3.42	14.67
REC-Krishnagiri							
C2038	13.13	1719.41	18.77	0.60	71.41	55.47	74271
G4	13.00	1519.99	23.43	0.60	71.06	54.65	63003
Suvarna 2	13.25	1612.71	20.81	0.58	70.83	48.76	61494
Vishala	13.44	1509.51	19.89	0.55	70.85	48.16	62895
V1	14.25	1749.11	21.31	0.57	70.08	50.72	59022
CD at 5%	NS	60.69	0.21	0.01	0.79	2.24	2246
CV%	8.56	6.79	7.50	3.46	1.19	8.84	8.68
KSSRDI-Thalaghattapura							
C2038	15	1083	16.61	0.66	73.93	89.90	52244
G4	14	1224	19.40	0.65	75.26	88.67	55379
Suvarna 2	15	1293	16.07	0.59	75.18	87.96	50945
Vishala	14	1288	15.28	0.56	74.52	88.39	53092
V1	15	1447	16.83	0.58	74.90	89.61	53595
CD at 5%	0.38	56.04	0.35	0.02	0.38	NS	NS
CV%	2.74	12.00	8.49	7.19	0.81	1.61	9.68
APSSRDI-Hindupur							
C 2038	NA	735.01	18.44	0.43	70.44	89.49	33913
G 4	NA	924.11	18.59	0.45	73.84	92.17	45122
Suvarna 2	NA	836.69	17.84	0.44	71.38	90.43	40162
Vishala	NA	907.50	18.36	0.44	70.37	91.13	43428
V1	NA	931.43	19.24	0.45	69.91	92.83	44569
CD at 5%		94.27	NS	NS	NS	1.27	6523
CV%		10.89	4.89	4.76	4.08	1.60	15.74

MOLECULAR BIOLOGY LABORATORY-1

I. Ongoing Projects

PIG 3502 (DBT): Sustaining mulberry yields: Identification of QTLs conferring resistance to root rot disease by Linkage Disequilibrium mapping and trait introgression (Jun. 2013 to Sep. 2015)

V. Girish Naik (PI), V. Nishitha Naik, M. S. Rukmangada (JRF), R. Triveni (JRF), H. S. Poornima (JRF)

Objectives:

- Resistance response of mulberry germplasm to major causal fungus of root rot disease
- Molecular characterization of germplasm accessions to identify the contrasts for resistance and susceptibility
- Development of mapping populations

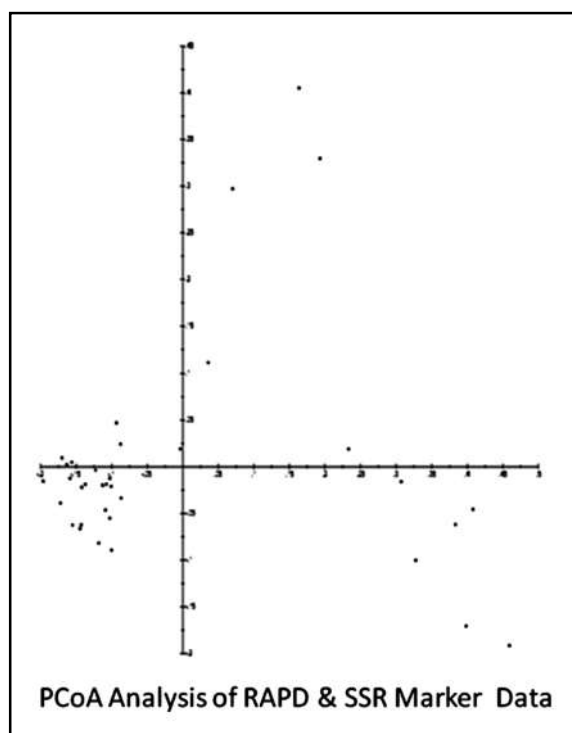
Two hundred and thirty one mulberry germplasm accessions were collected from CSGRC, Hosur and planted in nursery for raising saplings and establishment of the Panel of Diverse Germplasm (PDG) at the Institute. Fungal isolates (95) associated with root rot disease were collected from mulberry gardens (Karnataka, Andhra Pradesh, Telangana and Tamil Nadu). Cultural and morphological characteristics of fungal isolates were studied. *M. phaseolina* isolates (35) were profiled using 47 RAPD and 12 SSR markers. The genetic diversity among the isolates was assessed

and their distribution on cartesian planes is depicted by PCoA analysis. Dendrogram generated by dissimilarity coefficient matrices of RAPD as well as SSR markers resolved the fungal isolates into 9 clusters. Clustering phenotype of combined data (RAPDs + SSRs) was very similar to the one obtained through individual marker analysis. Mantel test indicated a high correlation ($r=0.81202$) between the RAPD and SSR matrices suggests consistency and suitability of both the marker system in diversity analysis of fungus. The results show that the fungus is able to colonize different locations aided by movement of pathogen, infected soils and plant materials through anthropogenic activities. SSRs with limited number markers (69 alleles) were able to provide similar result to that of RAPDs (260 markers) in the assessment of genetic diversity and interrelationships among the fungal isolates. *M. phaseolina* appears to be dynamic and omnipresent. Similarly, 50 isolates of *Fusarium* spp. and 10 isolates of *Botrydipodium theobromae* were also DNA fingerprinted using 25 and 52 RAPD primers, respectively. Results indicate that *Fusarium* isolates are highly variable as compared to *B. theobromae*. All the 95 fungal isolates were mass multiplied and inoculated to V1 pot culture plants and pathogenicity of each fungal isolate was assessed. Disease reaction among 20 mulberry germplasm accessions was evaluated using a virulent strain of *M. phaseolina* and results indicate that Moulai and Rosou are resistant.

A total of 130 new microsatellite primer pairs were custom synthesized for the characterization of diverse germplasm. PCR amplification was standardized for 35 primer pairs (F/R). Breeders' collection (36 accessions) was profiled using 35 newly standardized SSR markers. Profiling of the entire panel of germplasm using 14 new sets of SSR primers was completed.

Disease reaction of mulberry genotypes to root rot caused by virulent isolate of *M. phaseolina*

Genotype	Wilting (%)	Rotting (%)	Disease Reaction
S-1635	57.92	48.70	Moderately resistant
Mysore Local	27.47	36.56	Moderately resistant
V-1	41.67	34.11	Moderately resistant
K-2	50.42	32.49	Moderately resistant
S-34	50.62	49.49	Moderately resistant
G-4	50.99	35.91	Moderately resistant
S-36	92.59	48.22	Moderately resistant
RC-2	54.69	67.17	Susceptible
RC-1	68.72	58.23	Susceptible
Himachal Local	50.00	50.13	Moderately resistant
Rosou	63.58	32.49	Moderately resistant
Sujanpur-5	72.05	75.42	Highly Susceptible
Mouli	32.78	15.65	Resistant
S-30	68.59	55.95	Susceptible
C-776	63.59	32.68	Moderately resistant
S-763	44.73	29.77	Moderately resistant
S-799	59.20	18.81	Resistant
Okinawa	70.59	51.68	Susceptible
Muki	35.72	44.06	Moderately resistant
Kousen	32.11	29.18	Moderately resistant



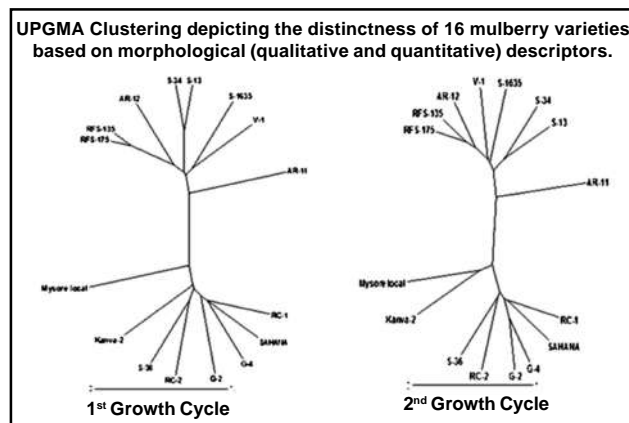
PIB 3507 (PPV & FRA): Development of Distinctness, Uniformity and Stability (DUS) descriptors for Mulberry (*Morus* spp.) and their Validation (Apr. 2013 to Mar. 2016)

V. Girish Naik (PI), S. Gandhi Doss, Rajashekar, K., T. Thippeswamy, P. Sowbhagya (SRF), B.B. Bindroo, V. Sivaprasad

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)

Fifty-seven descriptors including morphological, reproductive and growth characters have been short-listed and 16 cultivated varieties were selected for the assessment of extent of variation and validation. First (July-August, 2014), second (October - November, 2014) and third (March - April, 2015) round of growth cycle data on 16 identified cultivated mulberry varieties for all characters was completed. Identification of example/ reference varieties for different states of expression is under progress. The data recorded for 2 growing cycles was analyzed using DARwin program and the results are shown in the figures. The analysis shows that all 16 varieties can be grouped mainly into 2 subgroups as male and female varieties (genotypes) based on state of sex expression. AR-12 is distinct from other male varieties with shoot type having straightly curved nature. Plant vigor shows that AR11 and V1 as weak and strong varieties, respectively. S13 is distinct from other varieties having leaf shape with narrow ovate state of expression. S-1635 has spindle shaped buds; other varieties invariably have acute triangle shaped buds. S-34 is distinct from the other varieties having truncate leaf base. RFS135 and RFS175 are distinct from each other having a phyllotaxy of 1/2, 1/3 and 1/3, 2/5, respectively.



Categorization of Characteristics Expression

- * Essential characteristics for the international harmonization of variety descriptions and always be examined for DUS
 ** Bud, yield, MC%, MRC%

	Asteri- sked*	Non- asterisked	Sub Total	Quali- tative	Quanti- tative	Pseudo- qualitative
Plant	2	0	2	1	1	0
Shoot	5	6	11	2	7	2
Leaf	11	10	21	7	7	7
Inflorescence	7	5	12	4	8	0
Others **	2	9	11	4	7	0
Total	27	30	57	18	30	9

(RHS137C) leaf color and distinct from other varieties with dark green (RHS137A). RC2 can be distinguished from other varieties with young shoot color (purple brown, RHS 166A), while others have young shoot with green color (RHS139C). G2 and G4 are distinct from each other in leaf angle, semi-erect and horizontal, respectively. The identified descriptors satisfy three technical requisites of distinctness, uniformity and stability. A variety is considered to be clearly distinguishable if the difference in characteristic(s) is clear and consistent; therefore a mulberry variety is said to be uniform, subject to variation that may be expected for the particular features. Vegetative propagating feature of mulberry invariably ensures uniformity in characteristics. Stability will be tested by growing another generation from the new stock to ensure that it exhibits the similar characteristics under different environs.

Continuous/Other activities

Maintenance of mapping resources

- Yield and yield contributing traits: Mysore Local x V1 progeny (350 Nos)
- Water use efficiency (WUE) trait: Himachal Local x MS3 progeny (200 Nos); Muki x S34 progeny (432 Nos); G4 x MS3 progeny (182 Nos)
- Root trait: Dudhia White x UP progeny (560 Nos) and Punjab Local x Thaimale progeny (35 Nos)
- Alkaline tolerance: Sujapur5 x V1 progeny (169 Nos)
- Introgressed lines: WUE and root trait (20 Nos)

Leaf nature is an important characteristic in mulberry, with two states of expression: homophyllous or heterophyllous. Mysore Local is heterophyllous with both lobed and unlobed leaves in the same plant. Sahana is distinct from other female varieties with crenate leaf margin, while other varieties have serrate leaf margin. RC1 is distinguished from other varieties in fruit color (characteristic purplish-white) expression. K2 is distinct from other varieties with truncate leaf base. S36 has green

MULBERRY PATHOLOGY

I. Concluded Research Project

PRP 3486: Development of database for mulberry diseases (Aug. 2012 to Jul. 2014)

Pratheesh Kumar, P. M. (PI), V. Nishitha Naik, Guneshwar Kumar, C (Comp Programmer)

Objectives:

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

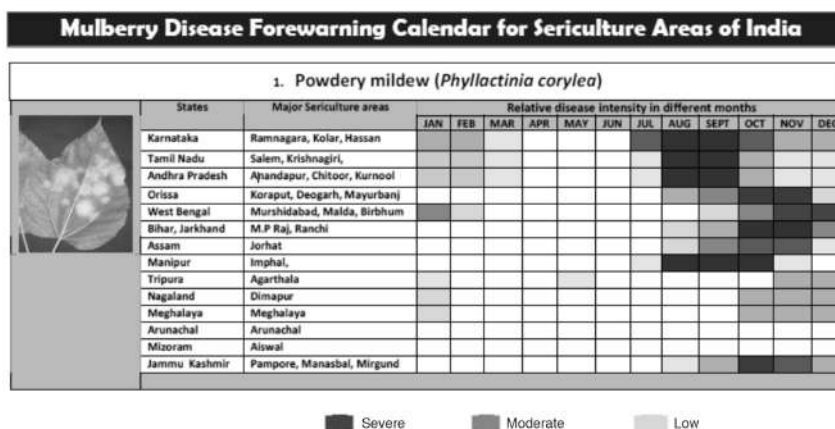
Methodology:

Secondary data from various sources such as research papers, published books, monographs, journals, annual reports of R&D institutes, project reports and thesis submitted on various aspects of mulberry diseases of various universities/institutions, websites were collected and referred for developing the database. The information was compiled and made detailed report of 22 diseases including brief introduction to the disease, symptoms, causal organism, systematic position, disease cycle, pre-disposing factors, varietal reaction and control measures (cultural biological and chemical) to the diseases. Calendars of seven important foliar diseases were prepared based on available data. Diagnostic keys of various diseases were also prepared. The project titles and objectives, investigators and year of implementation of R&D projects were compiled. About 335 published papers on various aspects of mulberry diseases were collected and PDF files were created. Various technologies developed for control of mulberry diseases were compiled and presented. About 105 FAQs and answers were made and uploaded in the web page. Further, a disease forewarning flash news about chances of outbreak of diseases and their preventive measures were included in the web page.

The database was constructed using MySQL as back end. Web page is created using HTML, Java script, PHP with a web based interactive interface with database using specific key board search and also have link to essential references to other external database. Personal computer with high-speed processor with minimum 4GB RAM and 500 GB hard disc Windows 2000/ 2003 XP is used for developing the web page.

Results and Discussion

Mulberry disease info web page has been developed with detailed information on 22 mulberry diseases. Diagnostic keys of 13 mulberry diseases with photographs of pathogens, pathogen propagules and infected plants were incorporated. R&D project reports pertaining to mulberry diseases in various Institutions of India were compiled. Research publications (PDF files) were uploaded in the database. Various technologies developed and recommendations suggested for the management of mulberry diseases were compiled and presented. FAQs (105) and answers pertaining to various aspects of mulberry diseases and their management were also presented. A news flash to forewarn about the possible outbreak of mulberry diseases and the management measures for timely management of the disease was provided.



Symptoms : White powdery patches on the lower surface of the leaves
 The corresponding portions on the upper surface develop chlorotic lesions
 The white powdery patches turn to brownish-gray-black; leaves turn yellowish and leathery.

Control : Cultural control: Follow wider spacing of plantation (90 cm x 90 cm) or paired row planting system [(90 + 150) x 60 cm]
 Chemical control: Spray 0.1% Carbendazim 50% WP (Bavistin) [2g/lit. water] or 0.2% Sulphur 80 WP (Sulfex) [2.5g /lit.].

Safe period: 5-7 days for Bavistin and 10 days in case of Sulfex.

The disease calendars pertaining to important foliar diseases viz. Bacterial leaf blight (*Xanthomonas campestris*), fungal leaf blight (*Alternaria alternata*), grey leaf spot (*Pseudocercospora mori*), leaf rust (*Cerotelium fici*), *Cercospora* leaf spot (*Cercospora moricola*), Tar spot (*Myrothecium roridum*), and powdery mildew (*Phyllactinia corylea*) incidence in various states were developed based on available literature along with disease severity (severe, moderate and less severe). Symptoms of diseases, control measures as well as safe period of chemicals used for the management of diseases is also provided in the calendar. These calendars would be useful for forewarning of the diseases and undertaking proper management measures. A part of webpage was meant for diagnosis of the diseases by physical verification (comparison of the infected mulberry part and verification of symptoms) and confirmation of the disease. Colour photographs of infected plants/plant parts, pathogen and propagules were included enabling easy diagnosis of diseases. Further, 335 research papers published during the last 50 years on various aspects of mulberry diseases were provided for reference.

II. Ongoing Projects

PRP 3530: Development of a broad spectrum formulation for management of mulberry root rot disease (Jan. 2015 to Dec. 2016)

Pratheesh Kumar, P. M. (PI), Thippeswamy, T.

Objective: To develop a broad spectrum formulation for effective management of root rot disease of mulberry

Root rot infected plants were collected from mulberry gardens of various parts of Karnataka and associated pathogens viz., *Fusarium solani*, *F. oxysporum*, *Botryodiplodia theobromae* and *Rhizoctonia bataticola* were isolated. Experiments are being conducted with several fungicides, alternative fungicides and plant derivatives effective against above fungal pathogens..

PRP 3535: Popularization of 'Nemahari' – a bionematicide for management of root knot disease in mulberry (Mar. 2015 to Feb. 2017)

V. Nishitha Naik, RSRs: H. Jayaram, S. Raja Kumar and M. A. Shanthan Babu

Objectives:

- To develop entrepreneurship model for application and commercial production of Nemahari
- To demonstrate effective crop protection through Nemahari for management of root knot disease
- To popularize Nemahari among sericulturists

Root knot caused by nematode, *Meloidogyne incognita* is a serious soil-borne disease and perennial nature of mulberry and endo-parasitic habit of nematode makes management of disease difficult. Nemahari was found effective against the root knot and large scale evaluation is being undertaken. The project was initiated in Karnataka, Andhra Pradesh and Tamil Nadu by procuring the raw materials for the production of Nemahari.

MPT 0046: Long term effect of mulberry cropping systems on soil biology and productivity (July 2011 to June 2014)

V. Nishitha Naik; Pratheesh Kumar, P.M.; S. Sen and Rekha, M.

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

Objectives:

- Study 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

Methodology:

120 soil samples were collected from identified mulberry gardens of Andhra Pradesh, Karnataka and Tamil Nadu

to study soil fungi, bacteria and actinomycetes prevalence in terms of frequency and relative density. The microbes were estimated by dilution plate technique (Waksman, 1927) and identified based on morphological and cultural characters (Ellis and Ellis, 1985; Agrios, 2000). Soil samples were also analyzed for chemical properties of soil such as pH, Electrical Conductivity (EC), Organic Carbon (OC), available Phosphorous (P) and Potassium (K) were analyzed by following standard procedure (Jackson, 1973). Available Zinc (Zn), Iron (Fe), Copper (Cu) and Manganese (Mn) were estimated by Atomic Absorption Spectrophotometer.

Microbes	Microbial Population ($\times 10^6$ CFU/ g Soil)					
	Andhra Pradesh	Avg	Karnataka	Avg	Tamil Nadu	Avg
Fungi	16.72-33.22	26.84	15.27-32.80	25.01	22.73-34.00	26.81
Bacteria	27.00-40.27	33.0	20.77-48.60	29.53	27.87-40.67	34.01
<i>Actinomycetes</i>	12.47-19.45	15.62	11.08-25.97	16.27	12.05-21.22	15.93
Total	55.05-88.92	75.54	52.68-100.07	70.80	65.52-93.48	76.75

	Microbial Population ($\times 10^6$ CFU/g Soil)			
	Beneficial	Saprophytic	Harmful	Total
Andhra Pradesh	28.25	35.05	12.24	75.54
Karnataka	26.75	34.23	9.82	70.80
Tamil Nadu	27.36	36.14	13.25	76.75
Total	82.36	105.42	35.31	223.09

Observations/Results:

The microbial population viz., total CFU of microbes/g soil ranged from 55.05-88.92 in Andhra Pradesh, 52.68-100.07 (Karnataka), and 62.52-93.48 (Tamil Nadu). Highest microbial population was in Tamil Nadu (76.75×10^6) followed by Andhra Pradesh (75.54×10^6) and Karnataka (70.80×10^6). Saprophytic microbes were more in mulberry gardens (105.42×10^6) as compared to beneficial (82.36×10^6) and harmful microbes (35.31×10^6).

The prevalent species of fungi belongs to genera of *Penicillium*, *Aspergillus* and *Rhizopus* and frequency (%) of occurrence in Andhra Pradesh was 99.35, 98.70, 90.96, Karnataka (100.00, 97.82, 82.6) and Tamil Nadu (100.00, 96.25, 96.25). Relative density was also higher in case of *Penicillium* in all the states and highest density was observed in Andhra Pradesh (31.9) followed by Karnataka (30.25) and Tamil Nadu (26.59). *Macrophomina*, *Alternaria* was less prevalent fungi in all the states. Among the bacteria, *Pseudomonas* and *Bacillus* were found in all the soil samples and relative density was higher as compared to other bacteria. *Actinomycetes* were present with less density in all the samples.

Soil sample analysis revealed varied characteristics: soil colour (light red - light

Microbes	Frequency (%)			Relative Density (%)		
	AP	KA	TN	AP	KA	TN
Fungi						
<i>Aspergillus niger</i>	98.70	97.82	96.25	22.79	19.4	17.04
<i>A. flavus</i>	6.45	24.63	16.25	0.32	1.89	1.38
<i>Rhizopus spp.</i>	90.96	82.60	96.25	23.46	14.53	14.13
<i>Penicillium spp.</i>	99.35	100.00	100.00	31.90	30.25	26.59
<i>Chaetomium spp.</i>	57.41	69.56	75.0	12.52	19.02	5.54
<i>Trichoderma spp.</i>	37.41	67.39	48.75	4.28	8.47	3.30
<i>Verticillium spp.</i>	9.03	5.79	22.5	1.36	0.44	24.49
<i>Fusarium spp.</i>	23.22	27.53	41.25	2.47	3.56	6.05
<i>Macrophomina spp.</i>	3.87	16.66	22.50	0.50	1.75	1.08
<i>Alternaria spp.</i>	3.87	4.34	5.00	0.40	0.69	1.29
Bacteria						
<i>P. fluroscence</i>	36.12	22.00	25.00	1.52	1.36	0.51
<i>Pseudomonas spp.</i>	100.00	100.00	100.00	40.38	34.49	35.99
<i>Bacillus spp.</i>	100.00	100.00	100.00	48.05	50.42	48.60
<i>Azospirillum</i>	73.54	74.00	90.00	7.46	9.36	10.09
<i>Azotobacter</i>	39.35	52.66	56.25	2.49	4.08	4.81
<i>Xanthomonas spp.</i>	3.87	0.55	0.00	0.10	0.29	0.00
Actinomycetes						
<i>Streptomyces spp.</i>	100.00	100.00	100.00	3.28	5.75	2.38
<i>Nocardia spp.</i>	100.00	100.00	100.00	1.26	2.16	1.25

black); texture (sandy loamy - sandy clay loam); pH (6.59- 8.34); EC (0.09-0.88); OC % (0.26-0.97); N (181.06-594.39 kg/ha); P (8.14-109.47 kg/ha); K (164.50-1164.83 kg/ha). Mean pH is above normal range in Andhra Pradesh and Tamil Nadu, whereas it is nearer to normal range in Karnataka (7.5). Average macro nutrients indicate that N is within the normal range (390.95-413.39 kg/ha), P and K is above normal range (25.23-41.98) and (383.24-440.68 kg/ha). Significant positive correlation was observed between microbial population with OC and N.

Chemical Property	Andhra Pradesh	Avg	Karnataka	Avg	Tamil Nadu	Avg	Normal Range
pH	7.11-8.43	7.86	6.59-8.34	7.51	7.35-8.05	7.72	6.5-7.5
EC	0.12-0.88	0.33	0.09-0.58	0.25	0.14-0.51	0.29	<1.0
OC %	0.36-0.82	0.62	0.26-0.97	0.62	0.44-0.86	0.65	0.65-1.00
N (kg/ha)	204.43-581.40	390.95	181.06-594.39	410.31	263.04-563.43	413.39	250-500
P (kg/ha)	8.14-109.47	32.71	13.93-67.10	25.23	13.25-99.60	41.98	15-25
K (kg/ha)	164.50-612.17	383.24	223.83-1164.83	440.68	201.67-612.33	389.91	120-240

Correlation of microbial population with chemical properties of soil samples

	Fungi	Bacteria	Actino- mycetes	Total	EC	OC%	N (Kg/ha)	P (kg/ha)	K (kg/ka)	
Andhra Pradesh	pH	0.013	-0.115*	0.063	-0.051	0.031	-0.076	-0.086	0.113*	-0.087
	Fungi		0.336**	0.152**	0.744***	-0.051	0.014	0.005	0.155**	0.081
	Bacteria			0.025	0.822***	-0.043	0.120*	0.084	0.151**	0.003
	Actinomycetes				0.371**	0.036	-0.082	-0.081	-0.003	0.023
	Total					-0.042	0.062	0.035	0.173**	0.047
	EC						-0.071	-0.057	-0.143**	0.217**
	OC%							0.972***	0.210**	-0.161**
	N (kg/ha)								0.180**	-0.140**
	P (kg/ha)									0.140**
Karnataka	pH	0.013	0.139*	0.129*	0.127*	0.293**	0.077	0.050	0.125*	0.225**
	Fungi		0.470**	0.036	0.768***	0.171**	-0.040	-0.044	0.032	0.198**
	Bacteria			0.173**	0.839***	0.256**	-0.010	-0.030	0.123*	0.409**
	Actinomycetes				0.460**	0.082	0.073	0.075	0.058	0.103
	Total					0.253**	0.000	-0.012	0.103	0.358**
	EC						-0.024	-0.014	0.133*	0.455**
	OC%							0.971***	-0.044	-0.034
	N(kg/ha)								-0.060	-0.045
	P(kg/ha)									0.180**
Tamil Nadu	pH	0.038	0.028	0.033	0.047	0.248**	-0.042	-0.037	-0.017	0.086
	Fungi		0.238**	0.118	0.714***	-0.166*	0.046	0.036	0.055	0.146
	Bacteria			0.142	0.786***	-0.011	0.042	0.023	0.026	-0.118
	Actinomycetes				0.453**	0.238**	-0.233**	-0.233**	-0.053	-0.012
	Total					-0.023	-0.021	-0.037	0.029	0.001
	EC						-0.122	-0.128	0.047	0.171*
	OC%							0.983***	0.069	-0.129
	N(kg/ha)								0.053	-0.150
	P(kg/ha)									0.014

The results indicate that pH, OC are the most important factors for alteration in soil microbial population. 83% of mulberry gardens are with pH above critical limit (>7.5) and 44% with OC below critical limit (<0.5%). Farmers have to be advised about the importance of soil testing and appropriate application of chemical, organic and green manures to improve soil health status. Qualitative and quantitative microbial activities are key factors for improving productivity and sustainability of soil health.

On-farm trial of Nemahari- A plant based formulation for management of root knot disease of mulberry

Pratheesh Kumar, P. M., V. Nishitha Naik, N. B. Chowdary (RSRS, Ananthapur), S. Raja Kumar (RSRS, Salem) and M.R. Subramanyam (RSRS, Kodathi)

Objective: To evaluate efficacy of Nemahari – a plant based formulation against root knot disease of mulberry

The OFT is conducted in states of Karnataka, Tamil Nadu and Andhra Pradesh and ten farmers each state with root knot were selected. Nemahari has been prepared and applied (@ 40 kg/ha after mixing with 400 kg FYM) during intercultural operations or after pruning or after leaf harvest by making trenches (15 cm deep near the root zone and

covered with soil). The garden needs to be irrigated immediately after application of Nemahari. Second and third application of Nemahari was conducted 70-80 days after first application and 140-150 days after second application.

States	Knots/ 50g root (No.)		Leaf yield (g)/plant		Disease Control (%)	Yield Increase (%)
	Treated	Control	Treated	Control		
AP	0.58	4.72	802.32	720.45	87.83	10.19
SD	0.22	0.493	8.787	7.211	0.221	0.493
TN	2.410	6.913	794.997	705.387	67.282	11.271
SD	1.519	2.77	39.53	41.32	14.27	3.494
KA	1.16	4.93	628.34	507.67	73.09	18.79
SD	0.411	1.795	37.69	36.291	7.475	2.002
Mean	1.38	5.52	741.88	644.50	76.07	13.42
P<0.01	**		**			
t-value	17.50		21.52			

Plants without application of Nemahari served as control. The data on root knot was collected by counting number of knots on 50g of randomly selected 30 mulberry plants and subjected for paired 't' test to assess for statistical significance.

The pooled data of 30 farmers showed significant (P<0.01) decrease in number of knots and increase in leaf yield due to treatment with Nemahari against untreated control. The average number of knots ranged 0.20-5.23 in the treated plants against the untreated plants (3.17-13.73).

Similarly, the average yield/plant varied between 580.07-822.40g in Nemahari treated plants against control (461.50-741.83g). Maximum disease control observed was 94.78% with an increase in yield upto 21.73% due to treatment with Nemahari. The average disease control was 76.07% with an average increase upto 13.42%.

SOIL SCIENCE & CHEMISTRY

Continuous/Other activities

Monitoring of soil fertility status of mulberry gardens in Karnataka, Tamil Nadu and Andhra Pradesh (April 2014 to March 2015)

Sibayan Sen (PI), P. Sudhakar, J. Ravi Kumar and B. Kasi Reddy

Objective: To monitor the soil fertility status of mulberry gardens of Karnataka, Tamil Nadu and Andhra Pradesh and recommend fertilizers & manures for soil health

Diverse ranges of parameters of soil fertility (1521 samples) from different areas in South India were analyzed. Fertilizer and manure recommendations for specific mulberry gardens vis-à-vis soil status were given for sustained soil fertility.

Soil testing and analysis

Area	pH	Electrical Conductivity (mmhos/cm)	Organic Carbon (%)	Available Phosphorus (kg/ha)	Available Potassium (kg/ha)
Bangalore Rural (KAR)	5.91-8.92	0.05-0.59	0.05-0.92	3.9-88.1	90-762
Mysore (KAR)	5.85-8.48	0.06-0.68	0.35-1.15	6.5-81.6	134-672
Ramanagaram (KAR)	5.78-8.48	0.08-0.77	0.05-1.00	8.7-101.5	
Mandya (KAR)	7.02-7.70	0.12-0.45	0.22-0.80	11.4-235.9	45-358
Tumkur (KAR)	4.72-9.78	0.04-2.70	0.06-0.99	0.5-122.4	45-1882
Koppal (KAR)	7.16-7.94	0.14-0.61	0.06-0.79	26.9-108.3	
Haveri (KAR)	7.34-8.01	0.20-0.62	0.11-0.91	46.3-83.6	
Pudukottai (TN)	5.46-8.69	0.01-0.56	0.15-1.18	0.44-22.2	179-1210
Dindugul (TN)	6.86-8.86	0.03-1.55	0.09-1.61	0.20-29.3	224-1210
Krishnagiri (TN)	6.51-8.56	0.04-0.81	0.06-1.35	0.40-30.8	224-1210
Tirupur (TN)	6.27-8.75	0.03-0.85	0.07-0.88	0.22-25.5	179-1210
Palakkad (KER)	4.55-7.95	0.00-0.48	0.19-0.70	0.54-57.7	985-1210
East Godavari (AP)	6.38-8.52	0.01-0.11	0.20-0.92	2.4-75.1	90-2554
West Godavari (AP)	6.99-8.12	0.02-0.06	0.33-0.90		
Chittoor (AP)	6.45-8.12	0.02-0.70	0.23-0.92	7.90-100.0	90-582
Ranga Reddy (AP)	7.90-8.35	0.00-0.05	0.18-0.90	19.0-103.0	314-493

Validation of new recommendation of fertilizers/manures for V1 mulberry under irrigated conditions (Apr. 2014 to Apr. 2015)

S. Sen, T. Thippeswamy, M. T. Himmantharaj, V. Lakshmanan, P. Sudhakar, J. Ravi Kumar, B. N. Murthy (upto June, 2014) and B. Srinath (from July,2014)

Objective: To monitor the changes occurring in major chemical properties of soil for the new fertilizer dose from the point of view of crop productivity and soil health

Leaf yields indicate that control plots (350:140:140 kg NPK + 20MT FYM/ha/yr) registered higher values of 10.40,8.32 and 9.21 as compared to 9.84,8.275, and 8.36 MT/ha/crop in treated plots (150:60:90 kg NPK + 20 MT FYM + 20 kg biofertilizer/ha/yr + 1MT VAM/ha) in Vikarabad, Bidaraguppe and Salem, respectively. The corresponding values in Kodathi were 6.74 and 8.275 MT/ha/crop.

Other Programmes of continuous/routine nature:

Quality Testing of Disinfectants and inputs used in sericulture

Sibayan Sen

Quality analysis of various disinfectants/products/samples (881 Nos) was conducted and about Rs. Two lakhs were received as testing fees for the benefit of stakeholders in sericulture industry.

AGRONOMY

I. Concluded Research Project

MRP 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)

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

Budget: 1.95 lakhs

Objectives:

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

Methodology: The experiments were conducted with the following treatments. FYM @ 25 MT/ha/year is applied as per recommendation.

T1: 350 N: 140 P: 100 K kg/ha (Recommended dose as control)

T2: 300 N coated with neem oil (0.5% v/w):140 P: 100 K kg/ha

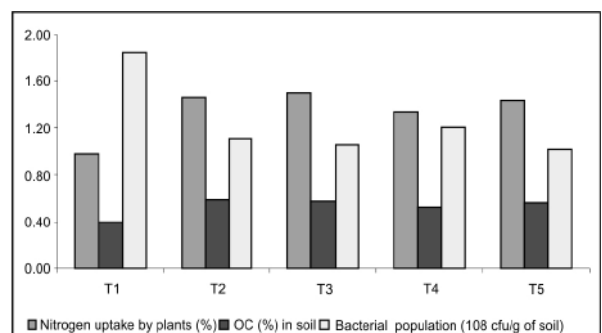
T3: 300 N coated with DCD (0.50% w/w):140 P: 100 K kg/ha

T4: 250N coated with neem oil (0.5%v/w):140 P: 100 K kg/ha

T5: 250 N coated with DCD (0.50% w/w):140 P: 100 K kg/

ha

Results: Nitrogen use efficiency over control (recommended dose of fertilizers) increased in T3. All the treatments combining nitrification inhibitors increased the nitrogen uptake as well as organic carbon (%) content in soil. The growth parameters and mulberry leaf yield significantly increased over control in T3 (11235 kg/ha) followed by T2 (10925kg/ha). Application of neem oil as natural nitrification inhibitor along with urea was more cost effective



and eco-friendly (T2) indicating enhanced nitrogen use efficiency. Nitrification inhibitors inhibited the growth of nitrifying bacteria (1.85 to 1.02×10^8 cfu/g), which is responsible for transformation of urea into nitrate form of nitrogen and nitrogen is retained for longer periods in the soil for plant utilization. Uptake of nitrogen by plants and available nitrogen in the soil significantly improved in treated plots as compared to recommended dose of nitrogen.

Effect of nitrification inhibitors on mulberry growth and yield
(Average of eight crops)

Treatments	Leaf yield (kg/ha)	Plant height (cm)	Length of longest shoot (cm)	No. of shoots / plant	Leaf moisture content (%)
T1	9942	148	125	14.5	72.4
T2	10925	149	125	13.5	72.0
T3	11235	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

Effect of nitrification inhibitors on soil characteristics and nutrient uptake

Treatment	Soil Analysis				Nutrient Uptake (%)	
	pH	EC (mmhos/cm)	Available P (kg)	Available K (kg)	P	K
T1	7.8	0.30	88.00	276.25	0.52	1.08
T2	7.7	0.33	119.25	309.75	0.57	1.16
T3	7.6	0.24	129.25	324.25	0.54	1.13
T4	7.7	0.34	124.00	317.25	0.55	1.17
T5	7.5	0.30	125.50	317.75	0.59	1.19
LSD (P<0.05)	NS	NS	11.92	17.07	0.093	0.264

Outcome of the project: Application of urea along with nitrification inhibitors significantly improved the leaf yield and plant height over recommended dose of fertilizer revealing retention of nitrogen for longer periods.

Continuous/Other activities

Effect of endophytic bacterial biocontrol agents of mulberry *Burkholderia cepacia*, *Bacillus subtilis* and *Pseudomonas aeruginosa* on growth and cocoon characters of silkworm

V. Gunasekhar and M. Munirathnam Reddy

Objective: To determine the effect of oral feeding of BCAs on silkworm growth and development

Methodology: Bioassay was conducted on the effect of BCAs of mulberry (*Burkholderia cepacia*, *Bacillus subtilis* and *Pseudomonas aeruginosa*) and its consortium on silkworm growth and cocoon characters by oral feeding (5 ml @ 10^6 and 10^8 cfu/ml) to the 5th instar (first feeding) silkworm larvae and the rearing was continued with normal leaves. Larval growth was weighed at a frequency of 24h for five days. Amylase and protease activity was measured on fifth day of 5th stage larvae by following standard procedures.

Results: Larval growth increased (2.26 - 22.3%) over control in different treatments and 6.3% increase in larval weight was observed in 10^8 CFU treatment on 5th day. Amylase activity increased in all treatments and maximum activity (164.20 μmoles/min/ml) in *B. Cepacia* treated (10^8 CFU) mid gut tissue and 225 μmoles/min/ml in *B. subtilis* treated (10^6 CFU) midgut juice. Protease activity also increased to 282.12% μmoles/min/ml in 10^6 CFU treated *B. subtilis* mid gut juice. Single cocoon weight, single shell weight and SR% also increased in all treated silkworm larvae and varied (2.78% - 14.28%) in different treatments. Results indicate that BCAs even at 10^6 and 10^8 CFU could be safely used for the control of soil born diseases of mulberry.

Effect of BCAs (CFU) on silkworm growth (Jayachamaraja)

Bacteria	Wt. of 10 Larvae (g)		10 ⁶			10 ⁸		
	10 ⁶	10 ⁸	SCW	SSW	SR%	SCW	SSW	SR%
<i>B.cepacia</i>	45.47 (2.43)	46.45 (4.59)	2.12	0.45	21.64	2.05	0.46	22.76
<i>B.subtilis</i>	45.46 (2.31)	46.89 (5.56)	2.20	0.48	21.81	2.21	0.48	21.70
<i>P.aeruginosa</i>	45.39(2.29)	47.18(6.21)	2.18	0.45	20.64	2.23	0.47	21.07
Consortium	45.95(3.498)	45.27(6.21)	2.20	0.48	22.12	2.20	0.48	22.11
Control	44.48	44.42	2.05	0.42	20.48	2.06	0.41	20.50

Figures in parenthesis indicate the per cent increase over control

Effect of BCAs (CFU) on amylase and protease activity of silkworm (MJ: midgut juice; MT: midgut tissue)

Bacteria	Amylase (μ moles/mim/ml)				Protease (μ moles/mim/ml)			
	10 ⁶		10 ⁸		10 ⁶		10 ⁸	
	MJ	MT	MJ	MT	MJ	MT	MJ	MT
<i>B. cepacia</i>	0.028	0.036	0.027	0.037	0.029	0.070	0.33	0.08
<i>B. subtilis</i>	0.039	0.034	0.024	0.029	0.34	0.005	0.24	0.058
<i>P. aeruginosa</i>	0.014	0.015	0.015	0.016	0.13	0.039	0.164	0.056
Consortium	0.015	0.017	0.014	0.016	0.17	0.030	0.15	0.038
Control	0.012	0.014	0.013	0.014	0.089	0.021	0.090	0.024

in vitro* evaluation of *Bacillus subtilis* and *Pseudomonas aeruginosa* on the suppression of growth and hyphal morphology of *Rhizoctonia bataticola

V. Gunasekhar and Vineet Kumar

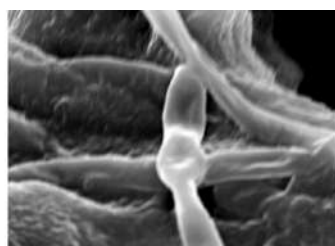
Objective: To determine the effect of *Bacillus subtilis* and *Pseudomonas aeruginosa* on the growth and hyphal morphology of *Rhizoctonia bataticola*

Dual culture assay was used to assess the growth and hyphal morphology of *Rhizoctonia bataticola*. 5 mm bits of seven day-old cultures were plated on PDA and 48 h old *B.subtilis* and *P.aeruginosa* were streaked 2 cm away from the middle of fungal plug and incubated at 35°C in a BOD incubator. Growth of fungal colony was observed at 24 h intervals and maximum growth was observed in control plates within 48 h, whereas in treated plates no growth was recorded. The morphology of mycelial tips at edges of treated and control plates were observed by SEM. Fungal mycelia were observed with irregular bulging, widening of mycelial threads and curling of hyphal tips. The growth of *R. bataticola* may be curtailed by deformation of hyphal threads.

SEM studies on effect of BCAs (*B. subtilis* and *P. aeruginosa*) on hyphal morphology of *R. baaticola*



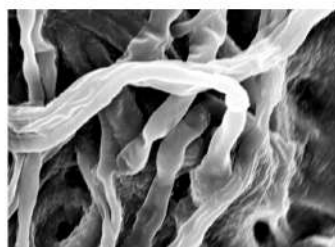
Curling and broadening of hyphae



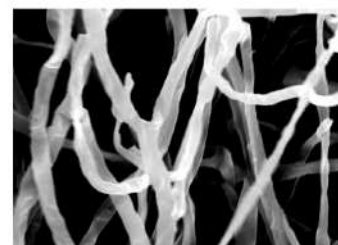
Bulging of hyphae



Broadening of hyphal threads



Irregular swelling/bulging of hyphae



Normal hyphae (Control)

BIVOLTINE SILKWORM BREEDING LABORATORY

Concluded Research Projects

AIB 3498 (Inter institution project): Popularization of authorized silkworm hybrids among the farmers of South India (Nov. 2012- Oct. 2014)

CSRTI, Mysuru; KSSRDI, Thalaghattapura; APSSRDI, Hindupur; NSSO, Bangalore; CSTR, Bangalore

Budget utilized: Rs 53,36,729/-

Objective: Popularization of the authorized silkworm hybrids for commercial exploitation and selection of suitable hybrids for different zones/locations

Four bivoltine hybrids viz., CSR16 x CSR17, CSR46 x CSR47, GEN3 x GEN2 and APS45 x APS12 and two multivoltine x bivoltine hybrids, MH1 x CSR2 and APDR15 x APDR115 were selected for popularization among the farmers of South India. The progenitor R&D institutes of the parental breeds have supplied the P1 dfls (CSRTI-Mysuru: CSR16, CSR17, CSR46, CSR 47, GEN3 & GEN2; KSSRDI-Thalaghattapura: MH1; APSSRDI-Hindupur: APS45, APS12, APDR15 & APDR115) to the adopted seed rearers of NSSO for generation of seed cocoons. The seed cocoons were procured and hybrid dfls were prepared by identified SSPCs of NSSO. The progenitor institutes have supplied the hybrids dfls (CSRTI-Mysore: CSR16 x CSR17, CSR46 x CSR 47 & GEN3 x GEN2; KSSRDI-Thalaghattapura: MH1 x CSR2; APSSRDI-Hindupur: APS45 x APS12 & APDR15 x APDR115) to the farmers through the RSRs/RECs. The crops were monitored by the identified local DOS Officer/Official and CSB Scientists. The data on various rearing parameters were collected from the farmers thorough the RSRs /RECs. Test reeling for silk quality was carried out at CSTR, Bangalore by purchasing the cocoon lots from the farmers.

After reviewing the data of two trials, three bivoltine hybrids viz., CSR46 x CSR47, GEN3 x GEN2 & APS45 x APS12 were dropped for further testing due to poor performance over the control hybrid. The bivoltine hybrid, CSR16 x CSR17 and two multi x bi hybrids, MH1 x CSR2 & APDR15 x APDR115 were continued for testing among the farmers.

CSR46 x CSR47: A total quantity of 99300 dfls of the hybrid was distributed to 396 farmers of Andhra Pradesh, Karnataka and Tamil Nadu. The average cocoon yield/100 dfls was 47.14 kg as against 62.00 kg in CSR2 x CSR4 (Control). The average price/kg of cocoon in CSR46 x CSR47 was Rs. 313/- as against Rs.320/- in control hybrid, CSR2 x CSR4. The hybrid was discontinued due to poor cocoon yield over control hybrid.

State	No. of dfls	No. of farmers	Yield/ 100 dfls	Rate/kg (Rs.)
Andhra Pradesh	49400	180	43.46	311
Karnataka	31800	165	54.48	348
Tamil Nadu	18100	51	58.78	281
Total/Avg.	99300	396	47.14	313
CSR2 x CSR4 (C)	125000	375	62.00	320

GEN3 x GEN2: A total quantity of 102600 dfls of the hybrid, GEN3 x GEN2 was distributed to 425 farmers of Karnataka, Andhra Pradesh and Tamil Nadu. The average cocoon yield/ 100 dfls were 60.44 kg as against 62.00 kg in CSR2 x CSR4 (Control). The average price/kg of cocoon was Rs. 314/- as against Rs.320/- in control hybrid, CSR2 x CSR4. The hybrid was discontinued due to lower cocoon yield over control hybrid.

State	No. of dfls	No. of farmers	Yield/ 100 dfls	Rate/kg (Rs.)
Andhra Pradesh	67900	250	60.80	340
Karnataka	15750	55	57.25	290
Tamil Nadu	18950	120	61.80	312
Total/Avg.	102600	425	60.44	314
CSR2 x CSR4 (C)	125000	375	62.00	320

APS45 x APS12: A total quantity of 6800 dfls of the hybrid APS45 x APS12 was distributed to 29 farmers of Karnataka and Tamil Nadu. The average cocoon yield/100 dfls was 42.74 kg as against 62.00 kg in CSR2 x CSR4 (Control). The average price/kg of cocoon was Rs. 317/- as against Rs.320/- in control hybrid, CSR2 x CSR4. The hybrid was discontinued for poor cocoon yield over control hybrid.

State	No. of dfls	No. of farmers	Yield/ 100 dfls	Rate/kg (Rs.)
Karnataka	2000	9	60.85	314
Tamil Nadu	4800	20	35.19	320
Total/Avg.	6800	29	42.74	317
CSR2 x CSR4 (C)	125000	375	62.00	320

CSR16 x CSR17: A total of 5,17,350 dfls were distributed among 2132 farmers of Andhra Pradesh (336850 dfls), Karnataka (86950 dfls) and Tamil Nadu (93550 dfls). The average cocoon yield/100 dfls for all the three states was 64.30 kg as against 62.18 kg in CSR2 x CSR4 (Control). The average price/kg of cocoon in CSR16 x CSR17 was Rs. 352/- as against Rs.362/- in control hybrid, CSR2 x CSR4 and silk quality of 2A-3A grade. This hybrid is being commercialized through NSSO.



MH1 x CSR2: A total quantity of 1, 13,650 dfls of MH1 x CSR2 were distributed to the farmers of Karnataka. The average cocoon yield/ 100 dfls were 61.52 kg as against 61.0 kg in PM x CSR2 (Control). The average price / kg of cocoon was Rs. 337/- as against Rs.300/- in control hybrid, PM x CSR2. The hybrid recorded silk quality of B to 2A grade. DOS Karnataka expressed difficulties experienced in reeling performance.

APDR15 x APDR115: A total quantity of 32,100 dfls of APDR15 x APDR 115 was distributed to the 113 farmers of Andhra Pradesh and Karnataka. The average cocoon yield/ 100 dfls were 53.89 kg as against 61.0 kg in PM x CSR2 (Control). The breeding institution expressed their inability to continue testing of the hybrid.

Conclusions

Systematic evaluation of authorized bivoltine hybrids suitable for different regions and seasons are essential for enhancing the crop stability at farmers' level. Several bivoltine hybrids were developed by different sericulture research Institutes to suit varying agro-climatic conditions prevalent in different zones. In this project, a total of 336850 dfls of CSR16 x CSR17 were distributed to 1222 farmers in Andhra Pradesh and the hybrid recorded an average cocoon yield of 62.97 kg/100 dfls. In Karnataka, a total quantity of 86950 dfls were distributed to 393 farmers and the hybrid recorded an average cocoon yield of 65.64 kg/100 dfls in Tamil Nadu, a total quantity of 93550 dfls were distributed to 517 farmers and the hybrid recorded an average cocoon yield of 67.70 kg/100 dfls. The average cocoon yield/ 100 dfls for 517350 dfls for all the three states was 64.30 kg as against 62.18 kg in CSR2 x CSR4. The average cocoon yield / 100 dfls at different locations in Andhra Pradesh indicated that, V.Kota with an average cocoon yield of 70.15 kg/100 dfls ranked highest followed by Madakasira (68.09 kg), in Karnataka highest cocoon yield of 69.69 kg/100 dfls was recorded in Shimoga. Where as in Tamil Nadu, highest cocoon yield of 70.36 kg/100 dfls was recorded in Udumalpet. The performance of MH1 x CSR2 indicated that, highest cocoon yield of 66.99 kg/100 dfls was recorded in Belgaum area and average cocoon yield/100 dfls for 113650 dfls was 61.52 kg as against 61.0 kg in PM x CSR2.

State	No. of dfls	No. of farmers	Yield/ 100 dfls	Rate/kg (Rs.)
Andhra Pradesh	336850	1222	62.97	338
Karnataka	86950	393	65.64	359
Tamil Nadu	93550	517	67.70	358
Total/Avg.	517350	2132	64.30	352
CSR2 x CSR4 (C)	273080	1063	62.18	362

State	Yield/ 100 dfls (kg)	Cocoon Wt. (g)	Shell Wt.(g)	Shell (%)
AP	62.97	1.791	0.379	20.8
KA	65.64	1.755	0.370	20.9
TN	67.70	1.739	0.372	21.0
Total/ Avg.	64.30	1.762	0.374	20.9

Location	No. of dfls	No. of farmers	Yield /100 dfls	Rate/ kg (Rs.)
Ramanagaram	88900	114	64.60	317
Belgaum	4300	10	66.99	266
Siddalagatta	10500	17	58.15	385
Hosakote	8950	13	55.29	383
Nandagudi	1000	5	47.00	370
Total/Avg.	113650	159	61.52	337
PM x CSR2 (C)	45800	130	61.00	300

Location	No. of dfls	No. of farmers	Yield /100 dfls	Rate/ kg (Rs.)
Hindupur/ Madanapalli	22,000	83	49.23	350
Chintamani	10,100	30	64.17	340
Total/Avg.	32,100	113	53.89	345
PM x CSR2 (C)	45,800	130	61.00	300

Inference

Popularization of CSR16 x CSR17 hybrid has motivated the farmers for rearing of new silkworm hybrids in place of existing hybrids resulting in better economic returns. This would motivate other farmers to take up new bivoltine hybrid silkworm rearing and consequently improve bivoltine cocoon production. The hybrid, CSR16 x CSR17 performed better than popular hybrid CSR2 x CSR4 and MH1 x CSR2 better than PM x CSR2. Hence, these hybrids serve as alternate resources to the existing hybrids and can be exploited commercially.

Ongoing Projects

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)

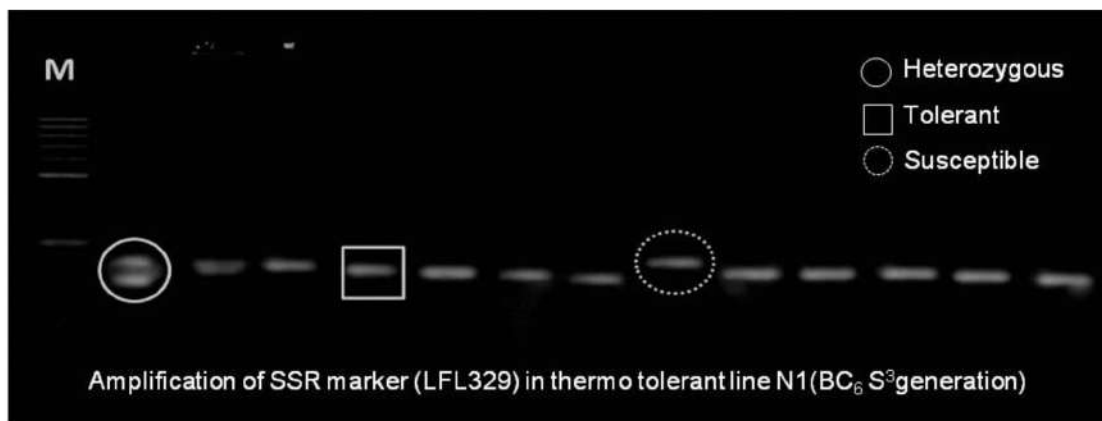
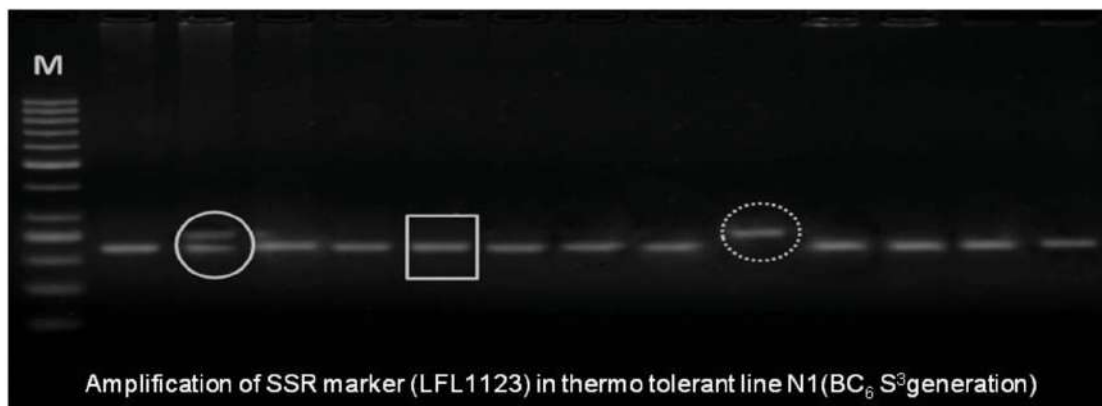
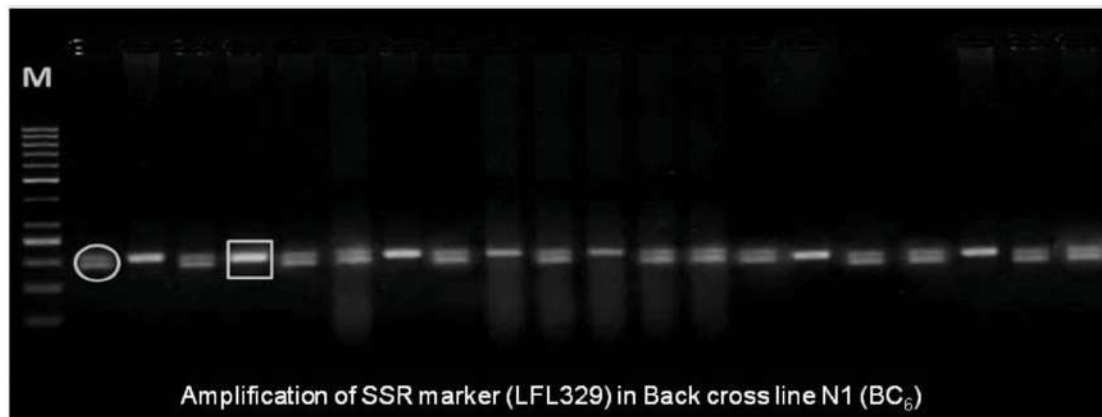
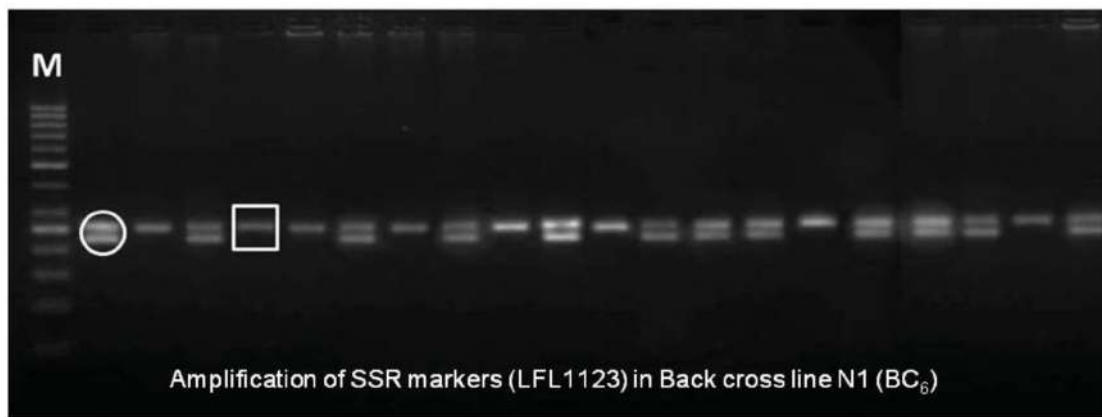
Objectives:

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

Bivoltine breeds, SK4C & APS110 were identified as donor parents based on SSR marker (LFL1123; LFL329) identified for thermo tolerance and four breeds viz. , oval: CSR27 & SK3 and dumbbell: CSR6 & CSR26 were selected as recurrent parents. Breeding for thermo tolerance was initiated by crossing the selected parents and the resulting F1s and BC progeny were raised. These lines were reared from BC₁ to BC₆S³ generation. The batches were screened for SSR markers in each generation by isolating DNA from 20-30 individual moths from each line. The progeny with SSR marker i.e., heterozygous pattern was selected for next cycle. The progeny showing homozygous dominant pattern was selected in each generation (BC₆S¹ to BC₆S³). Simultaneously, these lines were also exposed to high temperature conditions to confirm the genotypic expression. Four thermo tolerant oval lines (N1, N2, N3 & N4) and four dumbbell lines (N5, N6, N7 & N8) were developed. Hybridization evaluation of developed breeds with the other identified breeds is under progress.

Lines	Pupation Rate (%)		Yield/10000 L Wt. (kg)		Single cocoon weight (g)		Single shell Weight (g)		Shell Ratio (%)	
	26±1°C*	36±1°C*	26±1°C	36±1°C	26±1°C	36±1°C	26±1°C	36±1°C	26±1°C	36±1°C
N1	90.30 ±1.45	77.00 ±1.25	14.895 ±0.569	10.214 ±0.654	1.705 ±0.018	1.398 ±0.049	0.398 ±0.009	0.269 ±0.012	23.34 ±0.20	19.24 ±0.098
N2	92.00 ±1.624	73.00 ±0.785	14.958 ±0.748	10.015 ±0.581	1.700 ±0.036	1.420 ±0.062	0.401 ±0.012	0.287 ±0.020	23.59 ±0.150	20.21 ±0.085
N3	88.50 ±0.569	81.00 ±1.069	15.065 ±0.894	12.069 ±0.995	1.689 ±0.053	1.487 ±0.069	0.398 ±0.021	0.308 ±0.007	23.56 ±0.309	20.71 ±0.120
N4	91.30 ±0.789	78.00 ±1.36	15.230 ±0.803	11.201 ±1.02	1.706 ±0.048	1.510 ±0.037	0.403 ±0.018	0.306 ±0.014	23.62 ±0.239	20.26 ±0.189
N5	92.00 ±1.05	83.00 ±0.785	14.654 ±0.564	12.060 ±0.821	1.629 ±0.063	1.429 ±0.066	0.375 ±0.007	0.289 ±0.019	23.02 ±0.298	20.22 ±0.079
N6	92.00 ±1.25	83.00 ±1.31	14.685 ±0.623	11.741 ±0.745	1.678 ±0.084	1.439 ±0.072	0.385 ±0.020	0.289 ±0.023	22.94 ±0.389	20.08 ±0.136
N7	91.00 ±0.785	84.00 ±2.05	14.365 ±0.854	11.690 ±0.859	1.659 ±0.052	1.468 ±0.046	0.379 ±0.006	0.279 ±0.018	22.85 ±0.230	19.01 ±0.289
N8	92.00 ±1.025	85.00 ±1.789	14.305 ±1.025	11.209 ±0.915	1.620 ±0.039	1.360 ±0.033	0.362 ±0.016	0.258 ±0.016	22.35 ±0.265	18.99 ±0.246

* Humidity at 26±1°C is 70-85% and at 36±1°C is 75-95%



AIB 3509: Development of productive bivoltine silkworm breeds/hybrids of *Bombyx mori* L. tolerant to nuclear polyhedrosis virus (Jul. 2014 to Dec. 2018)

N. Mal Reddy, M. Balavenkatasubbaiah and S. Manthira Moorthy

Objective: Development of productive bivoltine silkworm breeds/hybrids tolerant to nuclear polyhedrosis virus

Second moult larvae of recurrent bivoltine parental breeds, CSR2, CSR4, CSR4(S), CSR6, CSR16, CSR17, CSR26, CSR27, CSR50, CSR51, CSR52, CSR53, S8, D2 & NB1 were screened for *BmNPV* tolerance @ 2×10^6 PIB/larvae. The rearing was conducted till cocooning and survival rate was calculated on pupation rate and twelve parental breeds: CSR2, CSR4, CSR6, CSR16, CSR17, CSR26, CSR27, CSR50, CSR51, CSR52, S8 & D2 were identified for initiation of breeding plans. Twelve breeding lines (oval x oval: CSR2N, CSR17N, CSR27N, CSR50N, CSR52N, S8N & D2N; dumbbell x dumbbell: CSR4N, CSR6N, CSR16N, CSR26N & CSR51N) were raised by crossing recurrent parental breeds with donor parents (oval: MASN6; dumbbell: 5N) and the breeding lines are at BC1 generation.

Performance of <i>BmNPV</i> tolerant breeding lines				
Breeding Lines	Pupation Rate(%)	Cocoon weight(g)	Shell weight(g)	Shell Ratio(%)
CSR2N	58.0	1.620	0.363	22.4
CSR17N	31.0	1.497	0.341	22.8
CSR27N	33.0	1.478	0.337	22.8
CSR50N	48.0	1.529	0.351	23.6
CSR52N	43.0	1.691	0.332	19.7
S8N	60.0	1.513	0.347	22.9
D2N	56.0	1.601	0.369	23.1
CSR4N	45.0	1.563	0.331	21.2
CSR6N	37.0	1.439	0.289	20.0
CSR16N	52.0	1.423	0.297	20.9
CSR26N	35.0	1.497	0.320	21.3
CSR51N	31.0	1.496	0.318	21.3

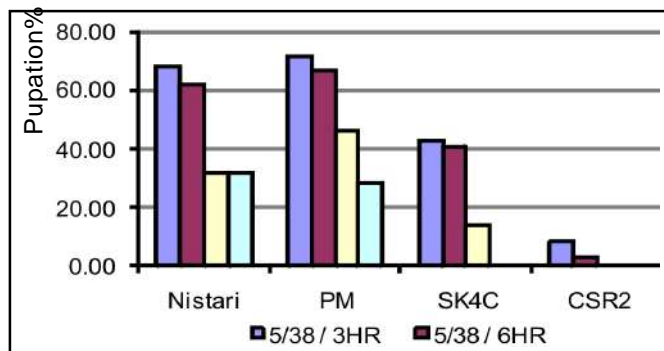
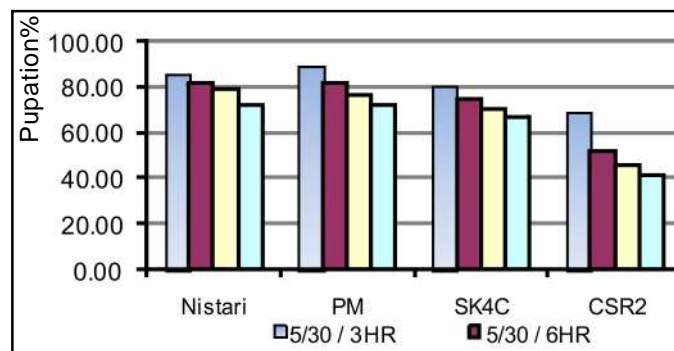
AIB3506 (DST-SERB): Studies on thermo tolerance, heat shock protein synthesis during thermal shock and inbreeding in silkworm, *Bombyx mori* L.

S. Manthira Moorthy (PI), Abhilash (JRF; upto 9.10.14) and N. Chandrakanth (JRF; from 10.2.15)

Objectives:

- Identification of critical thermal maximum in silkworm
- To analyze the profile of different forms of *hsps* in silkworm under thermal stress

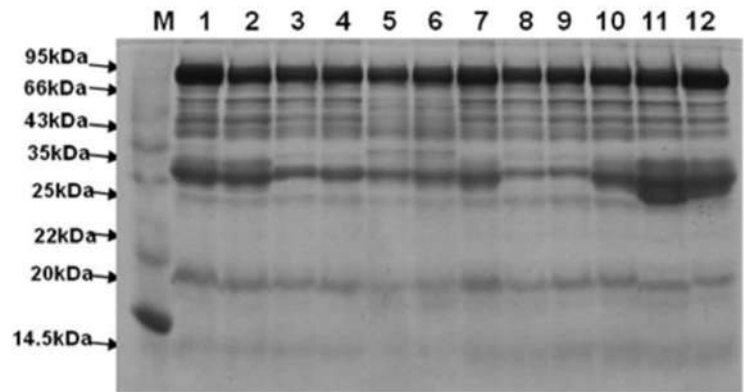
Two indigenous multivoltine breeds (Nistari & Pure Mysore) and two bivoltine (CSR2 & SK4C) were selected for the study in two sets of experiments to determine critical thermal maximum in silkworm. First day larvae of IV & V instar larvae were exposed to 30, 32, 34, 36 & 38°C for 3, 6, 9, & 12h every day. After specific period of exposure, the larvae were reared at normal temperature ($25 \pm 1^\circ\text{C}$) and was continued till spinning in the I set. Under the II set, 3rd day V instar larvae were continuously exposed to 36, 38, 40°C till spinning. Pupation (%) varied greatly with temperatures with durations and high reduction in pupation was observed in all the breeds in the larvae exposed to longer duration (9 & 12h). However, larvae exposed from IV instar onwards suffered more than V instar, since duration of treatment was longer. Pupation varied between 89 & 69%, 82 & 51.5, 79 & 45, 72 & 41% in the V instar larvae exposed to 30°C for 3, 6, 9 & 12h, respectively. Whereas, the same varied between 71.5 & 8, 67 & 3, 46 & 0, 32 & 0 in the V instar larvae exposed to 38°C for 3, 6, 9 & 12h, respectively. No larvae survived in CSR2 on 5th day after 9 & 12h exposure. Pupation varied greatly in the larvae of SK4C and CSR2 exposed to 38°C continuously and SK4C was able to survive till 42h. These results clearly demonstrate that silkworm can survive >24h even at 38°C.



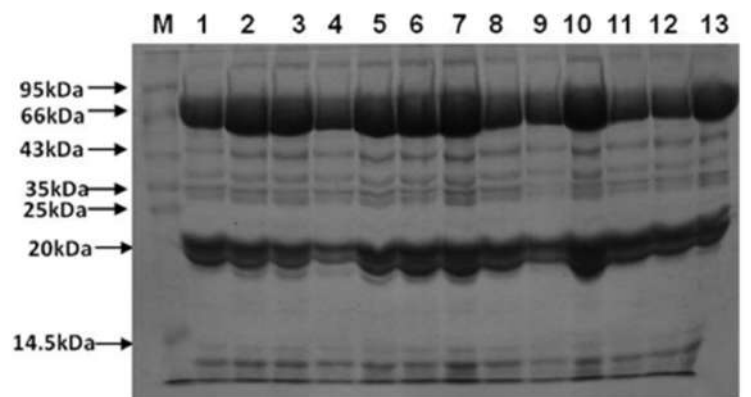
Haemolymph, midgut and fat body tissues of V instar larvae exposed to 30, 34, 36 & 38°C for 3, 6, 9 & 12h were analyzed by SDS-PAGE and data were recorded. The protein patterns of bivoltine (CSR2 & SK4C) exposed to 38°C for different duration revealed presence of ~11 polypeptides the haemolymph and ~30kDa showed lower expression in CSR2 after 3h of exposure (1st day) and higher expression at 9 & 12h of exposure. Similar observations were noticed in SK4C also, but ~23-24kDa showed higher expression at 9 & 12h of exposure. Further, no major changes in the expression of protein pattern was observed in V instar, but 20 & 70kDa family proteins showed higher expression throughout the period.

Based on 1D SDS-PAGE results, 9 polypeptides which were unique, highly/lowly expressed were identified for 2D gel electrophoresis. Remarkable variation in protein expression was observed between control and treated lots (CSR2-38°C). Particularly 100kDa protein expression varied between high or low depending on treatment, while 30kDa, 40kDa & 70kDa showed unique pattern.

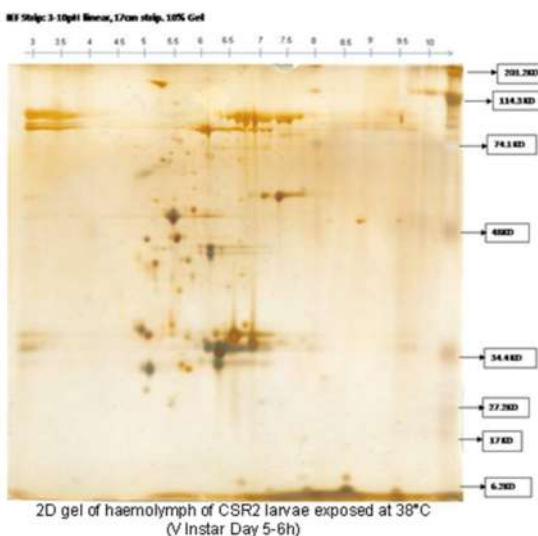
Based on 2D analysis, two specific spots (high & unique expression) from day 1-6h and day5-6h were subjected for MS/MS MALDI TOF to determine biological and molecular function of the expressed proteins. The database search program MASCOT Daemon (Matrix Science) against NCBI/nr/SWISS-PROT database with taxonomy specific to *Drosophila* (fruit fly, 232612 sequences) was used to compare protein sequence. Biological and molecular functions were also determined by UniProt Knowledgebase (SWISS-PROT & TrEMBL; <http://www.expasy.org/sprot>). The unique spot matched two genes with statistically significant protein score of 68 (P<0.05). The analyzed protein covered 10-11



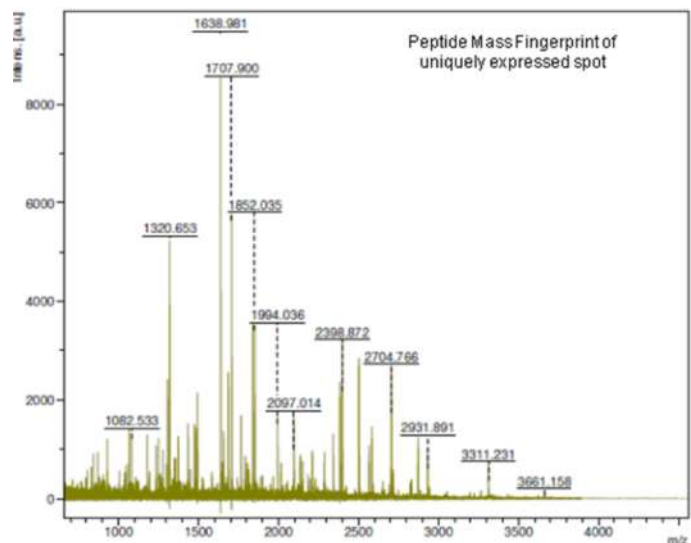
Haemolymph protein profiles of V instar 1st day larvae of CSR2 & SK4C exposed at 38°C. M:Marker; 1-6 lanes:CSR2; 1:Control; 2:1h; 3:3h; 4:6h; 5:9h; 6:12h; 7-12 lanes:SK4C; 7:Control; 8:1h; 9:3h; 10:6h; 11:9h; 12:12h



Haemolymph protein profiles of V instar 3rd day larvae of CSR2 exposed at 38°C continuously from 8h-30h. M:Marker; 1:Control; 2:8h; 3:10h; 4:12h; 5:14h; 6:16h; 7:18h; 8:20h; 9:22h; 10:24h; 11:26h; 12:28h; 13:30h



2D gel of haemolymph of CSR2 larvae exposed at 38°C (V Instar Day 5-6h)



Peptide Mass Fingerprint of uniquely expressed spot

peptides with 28.5% peptide coverage each and high similarity with gene ID 195347982 of *D. sechellia* and ID 195477573 of *D. yakuba* with molecular weights 58.85 and 32.65 kDa, respectively. Spot no. 2a and 2b were successfully predicted as Zinc ion binding proteins Alanine tRNA Ligase similar to *D. sechellia* and *D. Yakuba*, respectively. Another spot also had statistically significant protein score of 72 ($P < 0.05$) matched with gene ID 94764324 of *Drosophila ananassae*. The analyzed protein covered 4 peptides with 33.3% peptide coverage of *D. ananassae* with molecular weight of 6.46 kDa. The protein spot no. 1 was predicted as immuno protein Cdeil. Further work is under progress to ascertain biological function of other proteins.

Spot No.	Spot type	Matched organism	Gene ID	Peptide coverage	Protein score	Observed Mol. Wt. (kDa)
1	Unique	<i>Drosophila ananassae</i>	gj 194764324	4 (33.3%)	72	6.46
2a	Differential	<i>Drosophila sechellia</i>	gj 195347982	10 (28.5%)	68	58.85
2b	Differential	<i>Drosophila yakuba</i>	gj 195477573	10 (28.5%)	68	32.65

SIM 0008: Evaluation of three way cross hybrids for commercial exploitation (Jun. 2010 to Sep. 2014)

A. Naseema Begum (up to Apr. 2014), N. Mal Reddy, S. Nirmal Kumar (up to Apr. 2013) and Kariyappa

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

Two bivoltine dumbbell foundation crosses viz., FC1 FC3 and two oval FCs, FC2 and FC4 and seven each of oval (CSR2, CSR17, CSR27, CSR46, CSR48, CSR50 and CSR52) and dumbbell (CSR4, CSR6 CSR19, CSR26, CSR47, CSR51 and CSR53) bivoltine breeds were utilized and twenty eight three-way cross hybrids were prepared and evaluated. The important parameters governing silk quality and quantity such as fecundity, pupation, cocoon yield, cocoon weight, shell weight, shell percentage, reelability, filament length, raw silk percentage, filament size and neatness were considered for evaluation. The eggs/dfls in three-way cross hybrids ranged from 544 (FC1 x CSR50) to 589 (FC1 x CSR2), pupation from 92.3 (FC3 x CSR27) to 97.7 % (FC3 x CSR26), cocoon weight from 1.873 (FC4 x CSR19) to 2.123 g (FC3 x CSR2), shell weight from 0.423 (FC2 x CSR4) to 0.499 g (FC3 x CSR2), shell percentage from 22.2 (FC2 x CSR4) to 24.5 % (FC2 x CSR53), reelability from 85 (FC1 x CSR48) to 90 % (FC4 x CSR26) and raw silk percentage from 16.3 (FC4 x CSR19) to 19.1% (FC3 x CSR17). Highest filament length of 1227 m was recorded in FC3 x CSR48, while lowest of 1025 m was recorded in FC2 x CSR19. The neatness ranged from 92.0 to 94.0 points. Highest cocoon yield of 20.15 kg/10,000 larvae was recorded in hybrid, FC3 x CSR2 while lowest of 17.23 kg was recorded in FC2 x CSR19.

The multiple trait evaluation index indicated that twelve three-way cross hybrids have scored index > 50. The maximum of 62.1 was obtained for the hybrid FC3 x CSR17 followed by FC1 x CSR2 and FC3 x CSR2 which ranked second (60.6) and third (60.2), respectively. The cocoon uniformity in terms of standard deviation (SD±) calculated based on the length and breadth ranged from 6.40 (FC3 x CSR17) to 13.91 (FC3 x CSR48). The hybrid, FC3 x CSR17 recorded more uniformity (6.40 SD±) followed by FC1 x CSR2 (6.45 SD±), FC3 x CSR2 (6.75 SD±), FC1 x CSR17 (6.98 SD±). The control hybrid FC1 x FC2/ FC2 x FC1 has recorded cocoon uniformity of 7.75 to 7.84 SD±. The cocoon uniformity (SD±) less than 8, which is a target for selection of hybrid, was observed in many three- way cross hybrids.

FC3 x CSR17, FC1 x CSR2, FC3 x CSR2 & FC1 x CSR17 have been identified as best combinations in the order of merit with evaluation index >58.0, high heterosis and more cocoon uniformity. Two short -listed three-way cross hybrids, FC1 x CSR2 & FC3 x CSR17 were evaluated along with control single and double hybrids at RSRs and found superior over control single hybrid and on par with popular double hybrid.

A quantity of 20,300 dfls of (FC1xCSR2) was reared in AP, Karnataka and Tamil Nadu. The average cocoon yield/ 100 dfls was 65.2kg.

Performance of three-way cross hybrids

Hybrids	Fecundity	Pupation Rate (%)	Cocoon yield (kg)	Cocoon weight (g)	Shell weight (g)	Shell (%)	Reelability (%)	Fil. length (m)	Raw silk (%)	Fil. size (d)	Neatness (p)
FC1 x CSR2	589	96.1	19.23	2.022	0.481	23.8	89	1188	18.7	2.98	94
FC1 x CSR17	579	95.2	19.14	2.034	0.486	23.9	88	1177	18.6	3.08	94
FC1 x CSR27	560	94.9	18.63	1.972	0.463	23.5	87	1110	16.8	2.98	92
FC1 x CSR46	555	95.3	19.12	1.941	0.452	23.3	87	1066	16.9	3.01	93
FC1 x CSR48	545	97.3	19.65	2.035	0.466	22.9	85	1199	17.2	2.88	92
FC1 x CSR50	544	96.7	19.56	2.036	0.485	23.8	88	1097	17.6	3.10	92
FC1 x CSR52	552	96.3	19.12	1.985	0.470	23.7	90	1116	17.3	3.10	93
FC3 x CSR2	575	96.2	20.15	2.123	0.499	23.5	88	1145	18.1	3.02	94
FC3 x CSR17	588	97.5	19.98	2.039	0.481	23.6	88	1192	18.8	3.16	94
FC3 x CSR27	565	92.3	18.62	2.023	0.469	23.2	86	1083	16.6	2.97	94
FC3 x CSR46	559	97.2	19.86	2.045	0.474	23.2	87	1077	17.3	3.01	93
FC3 x CSR48	563	96.4	19.45	2.031	0.453	22.3	86	1227	15.9	2.86	94
FC3 x CSR50	557	95.6	19.53	2.050	0.478	23.3	88	1085	17.6	3.13	93
FC3 x CSR52	565	94.5	18.87	2.004	0.465	23.2	89	1094	17.6	3.02	94
FC2 x CSR4	570	96.2	18.25	1.907	0.423	22.2	88	1052	17.6	3.12	94
FC2 x CSR6	565	95.1	17.98	1.931	0.454	23.5	89	1066	16.6	3.10	93
FC2 x CSR19	555	93.3	17.23	1.891	0.425	22.5	87	1025	17.3	2.97	93
FC2 x CSR26	574	95.3	18.89	1.999	0.480	24.0	88	1087	17.2	3.23	94
FC2 x CSR47	566	93.1	17.24	1.912	0.449	23.5	89	1061	18.2	3.13	94
FC2 x CSR51	573	95.2	18.42	1.930	0.434	22.5	86	1108	17.9	3.12	93
FC2 x CSR53	565	95.7	18.63	1.957	0.479	24.5	88	1094	17.3	3.14	94
FC4 x CSR4	575	96.1	18.25	1.895	0.440	23.2	87	1061	17.9	2.99	94
FC4 x CSR6	560	96.5	18.72	1.932	0.458	23.7	88	1039	16.6	3.14	94
FC4 x CSR19	576	92.6	17.26	1.873	0.438	23.4	86	1029	16.3	3.21	93
FC4 x CSR26	555	97.7	19.25	2.055	0.475	23.1	90	1071	18.2	3.16	94
FC4 x CSR47	562	96.8	18.45	1.919	0.449	23.4	87	1082	17.6	3.23	93
FC4 x CSR51	558	95.4	19.26	2.060	0.472	22.9	88	1125	18.2	3.21	94
FC4 x CSR53	548	96.4	18.28	1.942	0.458	23.6	85	1032	17.6	3.11	94
FC1 x FC2 (C)	570	95.2	19.26	2.024	0.466	23.0	87	1150	18.0	3.12	94
FC2 x FC1 (C)	576	95.0	18.98	2.002	0.462	23.1	89	1170	18.3	3.21	94
CD at 5%	ns	2.1	1.52	0.09	0.028	1.03	ns	82	1.2	ns	ns

Evaluation index and cocoon uniformity in three-way cross hybrids

Hybrids	EI	Cocoon Uniformity(SD±)	Hybrids	EI	Cocoon Uniformity (SD±)
FC1 x CSR2	60.6	6.45	FC2 x CSR4	45.3	7.69
FC1 x CSR17	58.5	6.98	FC2 x CSR6	46.0	7.37
FC1 x CSR27	46.9	7.74	FC2 x CSR19	38.6	8.66
FC1 x CSR46	47.3	9.37	FC2 x CSR26	53.6	7.47
FC1 x CSR48	49.0	7.78	FC2 x CSR47	45.2	9.25
FC1 x CSR50	52.1	7.48	FC2 x CSR51	42.4	8.28
FC1 x CSR52	53.7	9.95	FC2 x CSR53	53.6	12.01
FC3 x CSR2	60.2	6.75	FC4 x CSR4	46.1	12.45
FC3 x CSR17	62.1	6.40	FC4 x CSR6	46.8	9.76
FC3 x CSR27	44.6	10.79	FC4 x CSR19	39.2	9.34
FC3 x CSR46	53.4	8.18	FC4 x CSR26	52.8	11.27
FC3 x CSR48	47.4	13.91	FC4 x CSR47	48.9	12.31
FC3 x CSR50	52.5	7.64	FC4 x CSR51	52.3	7.87
FC3 x CSR52	49.6	12.21	FC4 x CSR53	44.0	13.23
FC1 x FC2 (C)	52.2	7.84	FC1 x FC2 (C)	52.2	7.84

Rearing performance of three way cross hybrids at RSRs

Hybrids	Pupation Rate (%)	Cocoon yield/10000 larvae(kg)	Cocoon weight (g)	Shell weight (g)	Shell Ratio (%)	Reelability (%)	Filament length (m)	Raw silk (%)	Filament size (d)	Neatness (p)
FC1 x CSR2	95.3	18.18	1.847	0.393	21.3	86	972	17.0	2.72	94
FC3 x CSR17	94.3	17.63	1.782	0.390	21.8	85	961	16.8	2.78	94
Double hybrid	91.5	17.20	1.812	0.388	21.4	86	906	15.7	2.75	94
CSR2 x CSR4	92.5	16.77	1.764	0.383	21.7	85	899	16.0	2.63	93
CD at 5%	NS	0.85	0.04	NS	NS	NS	32	NS	NS	NS

Field Performance of three way cross hybrid, FC1 x CSR2

Location	Dfls (No.)	Number of Farmers	Yield/ 100 dfls (kg)	Cocoon weight (g)	Shell weight (g)	Shell Ratio (%)	Rate /kg (Rs.)
Andhra Pradesh	4000	10	68.5	1.976	0.435	22.0	366
Karnataka	7950	44	64.2	1.870	0.402	21.5	361
Tamil Nadu	8350	48	64.7	1.847	0.385	20.9	355
Total/Avg.	20300	102	65.2	1.912	0.410	21.5	361

Discussion: Double cross hybrids are popularized for their obvious advantages such as easy rearing of FCs and higher egg yields. Further, the polygenic expression is more stable than single hybrids in unfavourable environments because of genetic plasticity within the populations. However, utilization of bivoltine three-way cross hybrids for commercial exploitation is very limited. The rearing and maintenance of four inbred lines for purity is a difficult task while preparing double hybrids, the three- way cross hybrids involving one FC and an inbred line may be easier to maintain parental breeds. Results indicate that manifestation of heterosis may vary depending on extent of genetic distance and advancement and new three-way cross hybrids have shown desirable manifestation of hybrid vigour for most of the economic traits. Multiple trait evaluation showed FC3xCSR17, FC1xCSR2, FC3 x CSR2 and FC1x CSR17 as best combinations with an evaluation index >58.0, high heterosis and improved cocoon uniformity. FC1xCSR2 and FC3xCSR17 were selected and compared with control (single and double hybrids) at RSRs and were found superior over CSR2xCSR4 and on par with the popular double hybrid and these three-way cross hybrids can be exploited commercially during exigencies.

Inference: FC1xCSR2 is superior over existing popular single hybrid (CSR2 x CSR4) and on par with the popular double hybrid (CSR6 x CSR26) x (CSR2 x CSR27).

Other/Continuous Activities:

Maintenance of bivoltine silkworm breeds

N. Mal Reddy, C. M. Kishor Kumar, S. Manthira Moorthy and Y. Radhalakshmi

Objective: To maintain bivoltine parental breeds conforming to the original breed characteristics

Productive bivoltine breeds (10), robust bivoltine breeds (11), thin denier bivoltine breeds (2) and sex limited breeds (5) were maintained for evaluation of pre- and post-cocoon parameters. The overall performance of the breeds was in conformity with the original breed characteristics and on par with the benchmark values.

Maintenance of bivoltine breeds

Characteristics	Productive CSR2, CSR3, CSR4, CSR5, CSR6, CSR12, CSR16, CSR17, CSR26, CSR27	Robust CSR18, CSR19, CSR46, CSR47, CSR50, CSR51, CSR52, CSR53, S8	Thin denier CSR48, JPN7	Sex-limited CSR2-SL, CSR4-SL, CSR8-SL, CSR27-SL, CSR202-SL
Fecundity	>500	>500	>500	>400
Pupation rate (%)	>90	>90	>90	>80
Cocoon weight (g)	>1.70-1.80	>1.60-1.80	1.60-1.70	>1.50-1.60
Shell ratio (%)	>22-24	>22-23	>22-23	>20-21
Filament length (m)	>900	>900	>1200	>700
Raw silk (%)	>17.0	>15.0	>15.0	>13.0
Neatness (p)	>90	>90	>90	>90
Denier			2.2-2.4	

P4 BSF - HASSAN

Bivoltine silkworm race maintenance and multiplication

G. V. Kalpana and K. B. Chandra Shekar

Objective: Systematic silkworm race maintenance and supply to downstream multiplication centers.

Seven bivoltine silkworm breeds were maintained following recommended silkworm race maintenance technology in 4 crops. Mean data of pupation rate, Yield/10000 larvae by weight, single cocoon weight, single shell weight and cocoon shell percentage were recorded. The crops were meticulously monitored for pebrine incidence and the resultant dfls (10,920 dfls @ 31-43% egg recovery) were preserved as per requirement and utilized (3714 dfls to P3 & P2 centres) for further maintenance.

Breed	Performance of bivoltine breeds				
	Pupation rate (%)	Cocoon yield/10000 larvae (kg)	Single Cocoon weight (g)	Single Shell weight (g)	Shell Ratio (%)
CSR2	97.1±3.6	19.7±0.2	1.978±0.02	0.469±0.03	23.7±0.3
CSR4	94.5±1.8	16.5±1.4	1.746±0.04	0.377±0.02	21.6±0.6
CSR6	96.3±0.8	18.1±1.1	1.840±0.10	0.401±0.01	21.8±0.6
CSR26	95.0±2.3	16.4±0.5	1.730±0.10	0.372±0.01	21.5±0.2
CSR27	97.4±2.9	17.9±0.5	1.861±0.02	0.448±0.01	24.1±0.4
CSR16	95.9±0.9	17.5±0.3	1.824±0.10	0.399±0.01	21.9±0.7
CSR17	97.0±2.5	19.0±1.0	1.996±0.10	0.430±0.01	21.6±0.8

SATELLITE SILKWORM BREEDING STATION-COONOOR

Maintenance of Bivoltine breeder's stock of germplasm

E. Rajalakshmi and R. Gururaj

Objective: To maintain newly evolved breeders stock of bivoltine silkworm germplasm to its original characters

Thirty four bivoltine germplasm stocks were maintained in two crops. Mean data of fecundity, ERR by number, single cocoon weight, single shell weight and cocoon shell percentage were recorded. The crops were meticulously monitored for pebrine incidence and the resultant dfls were utilized for further maintenance.

Development of bivoltine breeds with higher productivity under semi-temperate conditions of Nilgiris (Sept. 2010 to Mar. 2015)

E. Rajalakshmi, R. Gururaj

Objective: To evolve new bivoltine breeds for higher productivity under semi-temperate conditions of Nilgiris

Maintenance of bivoltine germplasm stocks						Performance of CSRTI-Mysuru germplasm stocks					
Breed	Fec.	ERR (No.)	SC wt.(g)	SS wt.(g)	Shell Ratio (%)	Breed	Fec.	ERR (No.)	SC wt.(g)	SS wt.(g)	Shell Ratio (%)
CNR3	444	9440	1.780	0.370	20.78	CSR 2	562	8220	1.674	0.374	22.32
CNR4	510	9550	1.650	0.379	22.97	CSR 4	499	9640	1.818	0.381	20.96
CNR5	537	9002	1.626	0.364	22.53	CSR 6	524	9496	1.710	0.364	21.27
CNR14	472	8947	1.424	0.334	23.62	CSR 17	506	9610	1.607	0.350	21.76
CNR15	491	9480	1.586	0.353	22.28	CSR 26	517	9600	1.674	0.336	20.09
SLD1	454	9350	1.837	0.396	21.55	CSR 27	529	9581	1.714	0.403	23.50
SLD2	526	9227	1.713	0.375	21.87	CSR 46	568	9210	1.761	0.392	22.28
LD4	477	9590	1.604	0.346	21.54	CSR 47	528	9600	1.614	0.345	21.37
SLD6	461	9267	1.610	0.365	22.65	CSR 50	522	9230	1.788	0.417	23.34
SLD8	484	9470	1.572	0.338	21.50	CSR 51	488	9430	1.585	0.331	20.86
SLD9	457	8001	1.451	0.323	22.26	CSR 52	488	8510	1.760	0.400	22.72
D1	508	7996	1.540	0.349	22.66	CSR 53	552	9632	1.728	0.392	22.70
D2	524	9387	1.613	0.374	23.17	D 20	466	8881	1.704	0.377	22.15
D7	468	9130	1.718	0.405	23.58	Gen 3	549	9592	1.799	0.448	24.90
CSR202	456	8560	1.564	0.364	23.19	CD @ 5%	17	265	0.04	0.02	0.73
CSR204	444	9070	1.490	0.340	22.79	CV	5.75	4.90	4.27	8.64	5.64
D11	452	9610	1.514	0.339	22.38	These bivoltine germplasm stocks are utilized in the breeding programmes designated to the SSBS, Coonoor for developing productive bivoltine hybrids suitable for semi-temperate conditions					
D13	512	9640	1.643	0.353	21.46						
D15	480	9350	1.474	0.338	22.93						
D17	487	8570	1.599	0.364	22.74						
CD @ 5%	13	231	0.05	0.01	0.36						
CV	5.99	5.42	6.65	5.90	3.42						

Eleven oval breeds (CNR4, SLD1, CSR17, CSR46, CSR47, CSR50, CSR202, CSR204, Gen3, D7, D15) and four dumbbell breeds (SLD8, CS 6, D13, D17) were identified on overall performance from the germplasm stocks (SSBS-Coonor) as parental materials. Eight breeding plans were initiated and the lines were fixed at F8/F9 generations and reared (F11, F12, F13 & F14) during the period along with the hybrid evaluation trials. The quantitative traits targeted were achieved successfully (Pupation > 90 %; Cocoon wt. > 1.7-1.8g; Shell wt. > 36 - 44 cg; Shell ratio % > 21 - 24). Combining ability tests (30 hybrids) revealed that SSBS5 x SSB6 was found as the most promising one for OFT.

Performance of the short-listed hybrids

Hybrids	Fec.	Pupation Rate (%)	ERR. Wt (kg)	SC wt. (g)	SS wt. (g)	Shell Ratio (%)
7 x 1	567	9600	19.350	1.967	0.450	22.85
1 x 7 *	532	9608	19.936	2.044	0.472	23.08
3 x 7	553	9604	20.616	2.033	0.463	22.75
7 x 4 *	570	9533	20.570	2.073	0.479	23.11
4 x 8 *	561	9568	20.593	2.053	0.471	22.93
5 x 6 *	555	9630	20.048	2.040	0.476	23.32
5 x 7 *	551	9592	19.508	2.001	0.479	23.89
6 x 4	562	9600	20.327	2.066	0.469	22.68
8 x 4	568	9640	20.120	2.046	0.458	22.39
CD @ 5 %	9.17	24.47	0.36	0.03	0.01	0.33
CV	0.021	0.003	0.023	0.016	0.021	0.019

Breeding for robustness in bivoltine silkworm breeds under semi-temperate conditions

E. Rajalakshmi and R. Gururaj

Objective: To evolve new bivoltine breeds for robustness under semi-temperate conditions of Nilgiris

Ten bivoltine breeds (oval: CSR17, CSR46, CSR50, CSR52 & D7; dumbbells: D15, D20, CSR47, CSR51 & CSR53) were identified as breeding resource material and breeding program was initiated in Oct/Nov 2012. The F6, F7, F8 & F9 generations were reared during the period and line fixation is under progress.

Performance of shortlisted breeding lines for robustness

Breeds	Fec.	Pupation Rate (%)	ERR by Wt (kg)	SC wt.(g)	SS wt.(g)
RCNR 1	546	9446	1.658	0.368	22.18
RCNR 2	565	9352	1.590	0.360	22.66
RCNR 3	578	9353	1.644	0.353	21.49
RCNR 4	535	9523	1.649	0.361	21.87
RCNR 5	569	9131	1.646	0.357	21.66
RCNR 6	592	9133	1.533	0.331	21.57
RCNR 7	578	9098	1.642	0.361	21.99
RCNR 8	577	8502	1.523	0.320	20.98
RCNR 9	557	9402	1.521	0.324	21.23
RCNR 10	547	9126	1.506	0.325	21.56
CD @5%	12.20	197.91	0.04	0.01	0.33
CV	0.030	0.030	0.038	0.051	0.021

SILKWORM GENETICS LABORATORY

Ongoing Research Project

AIB-3528: Evaluation of G11 x G19: A new bivoltine double hybrid for sub-optimal conditions (Jan. 2015 to Dec. 2016)

K. K. Sharmila (PI), C. M. Kishor Kumar, Y. C. Radha Lakshmi, B. A. Parthasarathy and M. Ramesh Babu

Objective: To evaluate the field performance of newly evolved bivoltine double hybrid, G11 x G19 for productivity and silk quality.

P1 dfls of G11 (3240) and G19 (2850) were distributed to NSSO adopted seed rearers through SSPCs (Palakkad, Mysuru & Bengaluru). Seed cocoons generated (avg. yield: 65-72kg/100dfls; pupation rate: 92- 94%) were processed for hybrid production (2,43,500 dfls). G11xG19 cocoons spun on rotary and plastic mountages were tested for quality parameters at CSTRI and 3A-4A grade in the rotary montages and 2A-3A (plastic moutage) was recorded. 67,800 dfls were distributed to 393

Performance of Parental breeds and FCs (G11: GEN1 x 2C & G19: 4D x 4S)

Breed	Pupation rate (%)	Yield/10000 larvae (kg)	Cocoon weight (g)	Shell weight (g)	Shell Ratio(%)
GEN1	9180	14.94	1.642	0.362	22.05
2C	9124	14.72	1.643	0.365	22.19
4D	8880	14.16	1.689	0.368	21.73
4S	9130	14.77	1.682	0.364	21.66
G11	9162	15.32	1.722	0.382	22.18
G19	8984	14.72	1.694	0.371	21.59

farmers of Karnataka, Andhra Pradesh, Tamil Nadu and Maharashtra recorded 67kg/100dfis in Tamil Nadu followed by Maharashtra (65), Andhra Pradesh (61) and Karnataka (60kg).

Field performance of G11 x G19 during March 2015

Place	No.of farmers	Dfls	Yield/100 dfis	SCW (g)	SSW (g)	SR (%)
Karnataka	85	12800	60.10	1.620	0.350	21.60
AP	154	30750	62.00	1.795	0.362	20.20
Tamil Nadu	112	16850	67.00	1.77	0.365	20.621
Kerala	8	600	82.30	1.635	0.330	20.18
Maharashtra	34	6800	65.00	1.72	0.36	20.80
Total	393	67800	64.00	1.708	0.353	20.69

Quality characteristics of raw silk

Type	Rotary moutage		Plastic moutage	
	Value	Grade	Value	Grade
Average size	21.95		21.48	
Major tests				
Standard size deviation (d)	1.34	3A	1.50	2A
Evenness variation-I (stripes)	6	4A	10	4A
Evenness variation-II (stripes)	0	4A	0	4A
Cleanness (%)	99	4A	99	4A
Neatness (%)	94	4A	93	3A
Low neatness (%)	90	4A	88	3A
Auxiliary tests				
Maximum deviation (d)	1.9	1	2.15	1
Evenness variation-III (stripes)	0	1	0	1
Winding breaks/10 Skeins/hr	2	2	2	2
Tenacity (g/d)	3.8	1	3.7	1
Elongation (%)	18	1	19	1
Cohesion (strokes)	64	1	60	1
Overall Grade		3A		2A



Maintenance of silkworm breeds (amylase marker assisted, NPV tolerant and mutants)

K. K. Sharmila

Objective: Maintenance of silkworm races conforming to their original characters

Breed	Fec.	ERR/10000 larvae		SCW (g)	SSW (g)	SR %
		No.	Wt.(kg)			
GEN1	544±23.50	9222±170	14.3±0.358	1.625±0.07	0.36±0.02	22.26±0.47
GEN3	556±12.02	9181±388	15.48±0.740	1.680±0.03	0.38±0.02	22.49±0.36
2C	543±19.97	9261±245	15.03±0.540	1.680±0.03	0.38±0.02	22.49±0.36
3P	486±22.00	9100±094	14.89±0.740	1.652±0.30	0.36±0.60	22.30±0.30
GEN2	525±41.15	9058±114	14.88±1.210	1.660±0.01	0.35±0.01	21.42±0.97
4D	527±16.66	8890±245	14.15±0.290	1.630±0.04	0.35±0.01	21.58±0.48
4S	533±15.00	9160±411	13.61±0.630	1.658±0.08	0.36±0.02	21.69±0.30
4C	489±32.00	8280±190	13.29±2.190	1.606±0.40	0.35±0.30	21.54±0.10
6C	504±12.00	9030±326	14.55±1.530	1.612±0.20	0.35±0.30	21.65±0.40
2N	501±20.00	8250±122	10.77±3.89	1.203±0.25	0.240±122	18.78±2.37
5N	495±16.00	8920±766	11.37±2.10	1.356±0.33	0.264±0.06	19.55±0.54
61N	487±12.00	8140±205	12.56±1.72	1.489±0.40	0.322±0.113	21.24±2.51
63N	510±32.00	8240±382	10.15±1.838	1.285±0.320	0.268±0.080	20.69±1.39

Eleven bivoltine breeds (4 oval & 7 dumbbell) developed through amylase marker assisted selection, four NPV tolerant breeds and 26 mutant stocks were maintained conforming to their breed characteristics under two crops (Aug-Sept and Nov-Dec.2014). Homozygosity for amylase genes was confirmed by amylase assay utilizing amylase marker. Egg, larval and moth characteristics were maintained in the mutant stocks.

Marker Genes (Linkage group)	Description	Marker Genes (Linkage group)	Description
w-2 (10)	White egg 2, yellowish white eggs	K (11)	Knobbed dermal protuberances
Re (5)	Red egg, serosa cells red.	Rb (21)	Red blood
pe; re (5)	Pink eyed white egg	U (14)	Ursa, dark brown pigment on dorsal and lateral sides of larva
elp (18)	Ellipsoid egg	st (8)	Stony, larval body hard & compact
Ge (1)	Giant egg	tub (23)	Tubby, spindle shaped larva with short thorax & stout abdomen.
b-2 (6)	Brown egg	E (6)	Extra abdominal legs
sp (23)	Spindle shaped egg	nb (19)	Narrow breast, short thorax & stout abdomen
ch (13)	Chocolate newly hatched larvae	e (1)	Elongated II abdominal segment
pS (2)	Striped, black inter-segmental bands	la (9)	Dominant chocolate newly hatched larva
pM (2)	Moricaud larval markings	lu (16)	Lustrous eye in moths
Ze (3)	Zebra larval markings	Ws (17)	Wild wing spot in moths
lem (3)	Lemon coloured larval skin	Pk (2)	Pink coloured cocoon
L (4)	Multilunar spots on dorsal side	Y (2)	Yellow blood

MULTIVOLTINE BREEDING LABORATORY

Concluded Research Projects

AIB-3488: Pre-authorization field trials of L14 x CSR2: A new polyvoltine x bivoltine hybrid of the silkworm *Bombyx mori* L. with superior fibre qualities (Apr. 2012 to Mar. 2015)

CSRTI, Mysore; NSSO, Bangalore; CSTRI, Bangalore

Objectives:

- To improve the L14 breed with respect of its demerits like Variation in larval size, segregation in larval markings, variation in cocoon colour / shape and occurrence of trimoulters/hibernation
- Large scale field evaluation of new silkworm hybrid L14 x CSR2 with respect to cocoon yield and quality

Silkworm Breeding Laboratories at CSRTI-Mysore undertook breed improvement programme besides multiplication of L14 stocks required for seed cocoon generation. The lines were subjected to the following breeding strategies in each rearing cycle:

- Rearing of large number of cellular beds were brushed (minimum of 30)
- Bed wise observations on larval growth, larval markings, trimoulters and cocoon color/size uniformity
- Best families among the beds with highest pupation percentage
- Cocoon selection from the selected families
- Inter-batch crossing among the selected beds
- Selection of non-hibernating eggs for further maintenance
- Crossbreed evaluation with productive bivoltines as testers

L14 seed cocoons were generated at CSRTI-Mysore and the F1 Dfls (L14 x CSR2) were produced at CSRTI-Mysore and NSSO Units (SSPCs).

Performance of L14 breed under improvement programme

Gen.	Egg/dfl	Survival (%)	Cocoon weight (g)	Shell weight (g)	Shell Ratio (%)	Trimoulters (%)	Hibernation (%)
G1	425±30	84.64±10.14	1.080±0.14	0.200±0.03	18.56±0.98	1.35	1.68
G2	472±50	86.21±09.52	1.449±0.12	0.277±0.03	19.13±1.14	3.18	2.66
G3	559±60	86.68±02.79	1.468±0.05	0.251±0.02	17.10±0.81	4.15	2.31
G4	494±39	89.00±08.74	1.353±0.13	0.262±0.03	19.40±0.99	2.00	1.12
G5	519±60	92.00±05.00	1.481±0.04	0.298±0.01	20.12±0.40	0.00	2.47
Mean	494±48	87.71±7.24	1.366±0.10	0.258±0.02	18.86±0.86	2.67	2.05
CV (%)	9.69	8.25	6.98	9.16	4.58		

F1 dfls were distributed in the field and performance was recorded. L14 x CSR2 cocoons procured from field were tested for post cocoon quality parameters. The demerits like variation in larval size, variation in cocoon colour and shape were eliminated completely during the improvement process. The occurrence of trimoulters and hibernation are within the admissible limits and seasonal. The performance of thirty-three seed crops of L14 (7060 Dfls) recorded an average cocoon yield of 47.50 kg/100 dfls. The performance of the L14 x CSR2 recorded an average egg recovery of 57.506 g per kg of cocoon as against the NSSO norms of 60g in the seed production process.

Performance of L14 seed crops

Particulars	Performance			Overall
	2012-13	2013-14	2014-15	
No. of Seed crops	12	12	9	33
No. of dfls	3300	2450	1310	7060
Fecundity	474	453	449	458
Total larval duration (D:H)	22:06	23:06	23:06	22-23
5 th age larval duration (D:H)	5:12	05:18	05:18	05:16
Actual Cocoon yield (no)	974208	868821	873971	2717000
Actual Cocoon yield (kg)	1434	1115	684.10	3233.1
Cocoon yield/100 dfls (kg)	43.45	45.51	52.22	47.5
Survival (%)	82.14	84.67	90.83	85.88
Single cocoon weight (g)	1.385	1.492	1.518	1.465
Single shell weight (g)	0.247	0.274	0.275	0.265
Shell ratio (%)	18.10	18.37	18.11	18.19

L14 x CSR2 dfls production

	2012-13	2013-14		2014-15		Overall
	CSRTI	CSRTI	NSSO	CSRTI	NSSO	
No. of lots	19	04	09	01	11	44
Cocoon by number	1330926	119393	537150	4956	434424	2426849
Cocoon by weight (kg)	1738.46	347.15	760.5	7	598.72	3451.83
Pupation (%)	89.68	86.78	84.46	87.64	75.2	84.752
Percentage of pairs	31.72	30.42	32.205	32.68	34.50	32.30
Egg yield (g/kg of cocoon)	65.60	62.40	43.17	67.14	49.22	57.506
No. of eggs /g	1811	1797	1805	1740	1800	1790.6
Hibernation (%)	7.06	2.08	2.21	0	9.70	4.21
Total No. dfls produced	317050	26450	133025	1400	110750	588675

The overall performance covering 5,78,425 dfls (2623 farmers) recorded an average cocoon yield of 51 kg per 100 dfls and fetched a cocoon price of Rs.283 as against 62 kg and Rs. 247, respectively for the existing hybrid, PM x CSR2. Evaluation of post cocoon parameters indicated the superiority of L14 x CSR2 over PM x CSR2 in terms of shell%, filament length, reelability, raw silk, neatness and silk waste. Further, the test results of raw silk reeled on multi-end reeling machine (41 samples) and automatic reeling machine (2 samples) recorded A~3A and 3A grade quality silk, respectively.

Field performance of L14 x CSR2

State	Farmers	dfls	Yield/100 dfls (kg)
Karnataka	1298	336925	51.20
Andhra Pradesh	424	119000	48.9
Tamil Nadu	508	72900	53.77
Maharashtra	119	28550	57.32
Madhya Pradesh	56	8750	46.60
Tripura	199	8800	40.47
Orissa	15	3000	37.98

Reeling performance on multi-end reeling machine

Particulars	L14 x CSR2	PM x CSR2	Improvement (%)
Shell percent	21.49	18.67	15.10
Average filament length (m)	988	785	25.85
Non-broken filament length (m)	932	732	27.32
Reelability (%)	88	85	3.53
Filament size (d)	2.75	2.85	
Renditta	6.03	7.38	18.29
Neatness	91	88	3.40
Silk waste (%)	16.20	19.60	17.35

Inference/Recommendation: The field trial of L14 x CSR2 confirms its superiority in terms of quality of silk (2A-3A grade). However, its cocoon yield varied from 35-65 kg/100 dfls indicating the instability in crop performance in the field. The lower cocoon productivity was attributed to low survival and lower hybrid vigour.

Ongoing Research Projects

AIB 3546: Development of productive polyvoltine breeds of the silkworm *Bombyx mori* L. tolerant to high temperature and BmNPV (Oct. 2011 to Sep. 2016)

Dayananda (PI), V. Premalatha (Up to June 2014) and M. Balavenkatasubbaiah

Objectives:

- To develop polyvoltine breeds tolerant to high temperature and BmNPV
- To identify productive crossbreed

Eight short-listed stress-tolerant lines were reared for five generations under normal rearing conditions and further short-listed to four lines based on the average evaluation index (EI) of rearing/post cocoon quality parameters and mid-way evaluation of crossbreeds by using CSR2 as a tester. These four polyvoltine lines are currently under stabilization (F13).

Performance of stress-tolerant lines/hybrids under normal rearing

Lines/ hybrids	Survival (%)	SCW (g)	SSW (g)	Shell (%)	Reelability (%)	FL (m)	RS (%)	Neatness (P)	Average EI
L3	90.52	1.313	0.232	17.64	73.86	590	12.74	89	50.66
HB1	96.80	1.299	0.247	19.03	74.30	628	12.82	88	53.15
HB4	88.05	1.314	0.257	19.59	79.90	600	12.77	87	56.73
HB6	92.99	1.258	0.235	18.70	69.60	609	13.12	89	52.14
L3 x CSR2	96.24	1.766	0.359	20.32	86.22	907	15.96	89	56.26
HB1 x CSR2	92.78	1.741	0.375	21.51	84.14	903	16.02	86	51.66
HB4 x CSR2	88.08	1.818	0.389	21.39	85.44	880	15.15	88	52.49
HB6 x CSR2	93.88	1.742	0.375	21.50	83.25	890	16.10	87	54.43

AIB 3524: Improvement of Pure Mysore race for productivity and silk quality (Jan. 2015 to Jun. 2018)

Dayananda (PI), S.B. Kulkarni and Kariyappa

Objective: To develop Pure Mysore lines for improved hybrid vigor and fiber quality

The project is initiated with the collection of Pure Mysore stocks from NSSO and DOS, Karnataka and the lines are selected with the following characteristics for further development as per milestones.

Character	NSSO	DOS Karnataka	CSRTI Mysuru
Fecundity (no.)	410	500	448
Larval duration (days)	26	27	25
Cocoon weight (g)	1.009	1.014	0.996
Shell weight (g)	0.153	0.150	0.165
Shell %	15.14	14.78	16.55
Shape	Oval ends	Oval ends	Spindle

AIB 3534: Development of improved crossbreeds of silkworm *Bombyx mori* L. suitable for south India (Mar. 2015 to Mar. 2019)

Dayananda (PI), C. M. Kishor Kumar, M. Balavenkatasubbaiah and Y. C. Radhalakshmi

Objective: To develop crossbreed for high productivity and improved silk quality

The project is initiated and eleven identified parental stocks including six greenish yellow, two dark yellow and three white coloured cocoons from the breeding institutions were collected and the parental breeds are being maintained for further work.

Continuous/Other Activities

Development of new crossbreed Cauvery Gold (MV1 x S8)

V. Sivaprasad (PI), Dayananda, S. B. Kulkarni and M. Balavenkatasubbaiah

Objective: Development of improved crossbreed for productivity and silk quality

Performance of MV1 x S8 (Cauvery gold)									
Cross breed	Fec.	Survival (%)	SCW (g)	SSW (g)	Shell (%)	Reelability (%)	FL (m)	Raw silk (%)	Neatness (p)
Cauvery Gold	506	98.40	1.792	0.389	21.7	86	860	14.80	90
L14 x CSR2	490	84.53	1.654	0.329	19.9	88	811	14.04	90
PM x CSR2	475	93.22	1.534	0.298	19.4	84	663	13.40	86
Improvement*	3.27	16.41	8.34	18.24	9.05	2.33	6.04	5.41	
Improvement**	6.53	5.56	16.82	30.54	11.86	4.76	29.71	10.45	4.65

*: Over L14 x CSR2 **: Over PM x CSR2

Keeping in view of the unstable crop performance of the crossbreed (L14 x CSR2) in the field, demerits/low productivity issues and requirement of industry for quality silk for powerlooms, a new polyvoltine line (MV1) was isolated utilizing improved lines of L14 through directional selection and exposure to BmNPV (2×10^6 POB/ml @ 1 ml/100 larvae), BmIFV (10^{-4} dilution of stock solution @ 1 ml/100 larvae) and BmDNV1 (10^{-4} dilution of stock solution @ 1 ml/100 larvae). MV1 is characterized by high survival and further, a new crossbreed "Cauvery Gold", MV1 x S8 has been identified through hybrid evaluation utilizing and productive oval bivoltines. The new improved crossbreed (ICB) is characterized by higher productivity (>60 kg/100 dfls), superior fiber quality (2A-3A grade), light greenish yellow coloured oval cocoons with compact shell and good grains, which can be reeled completely till palade layer resulting high raw silk recovery and raw silk. MV1 x S8, newly developed ICB is being proposed for popularization during 2015-16 for the production of gradable crossbreed silk in the country.

Maintenance of polyvoltine silkworm breeds

V. Premalatha (Up to June 2014), Dayananda, and Kariyappa

Objective: Maintain the polyvoltine breeds conforming to their original characters

Thirty-five polyvoltine breeds were maintained conforming to their original breed characteristics for five generations and for utilization in the breeding programmes.

Performance of polyvoltine breeds									
Breed	Fec	Pupation Rate (%)	Cocoon weight (g)	Shell weight (g)	Shell Ratio (%)	Fil. length (m)	Reellability (%)	Raw silk (%)	Neatness (p)
ND7	454±80	89.34±5.20	1.344±0.19	0.237±0.04	17.62±0.61	512±48	82.72±8.29	10.66±0.87	87±1
NDV6	487±19	81.93±5.75	1.364±0.25	0.251±0.05	18.41±0.89	561±42	87.77±1.35	12.07±1.77	88±1
ND5	465±33	81.04±5.20	1.419±0.23	0.264±0.06	18.58±1.20	537±43	83.40±9.57	10.78±0.38	87±1
NP1	464±18	89.67±5.90	1.380±0.25	0.239±0.05	17.34±1.13	577±39	84.55±9.99	10.27±1.13	90±1
AGL3	557±23	84.83±8.00	1.360±0.23	0.249±0.05	18.32±0.77	578±16	84.84±1.63	11.37±0.67	88±1
AGL5	481±15	83.73±7.07	1.357±0.28	0.260±0.06	19.20±0.85	555±49	87.18±4.22	11.37±1.12	90±1
L15	488±07	80.88±9.07	1.423±0.26	0.260±0.05	18.30±1.83	553±19	86.73±1.04	10.96±1.25	89±1
L14	494±48	86.91±8.24	1.366±0.10	0.258±0.02	18.86±0.86	574±17	89.05±1.08	11.57±1.50	88±1

SILKWORM MOLECULAR BIOLOGY LABORATORY

I. Concluded Project

AIB-3476: Development of productive NPV tolerant bivoltine breeds/ hybrids using BmNOX marker assisted selection (Apr. 2012 to Mar. 2015)

S. K. Ashwath (PI) and Virendra Kumar

Budget: Rs. 2.90 lakhs

Objective:

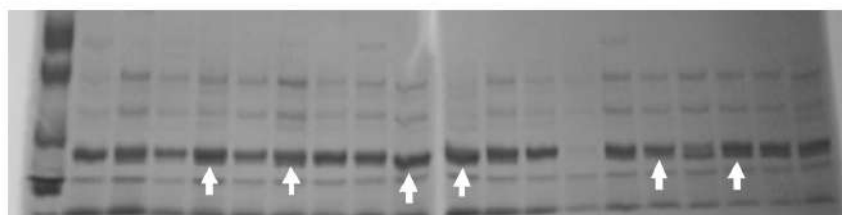
- To develop productive NPV tolerant bivoltine breeds using BmNOX as a marker
- To identify NPV tolerant single/double hybrids through laboratory evaluation and in-house testing

Though a number of productive bivoltine breeds of CSR series have been evolved, these are susceptible to diseases especially nuclear polyhedrosis caused by BmNPV resulting in low yields particularly with small and marginal farmers. Previous efforts made for development of silkworm races tolerant to BmNPV resulted in the evolution of bivoltine breeds (DR-, 2N, 5N, 61N & N2). A 26.5 kDa protein named BmNOX (NADPH oxidoreductase) in the gut fluid of Nistari strain of silkworm (polyvoltine) has been identified and characterized, which has antiviral activity against BmNPV. The full-length gene encoding BmNOX has been sequenced (NCBI GenBank; GI No.:169246570; 2008). Nistari, N2 & 5N (bivoltine) expressed significantly higher levels BmNOX. On this backdrop, molecular marker assisted selection utilizing BmNOX protein marker was undertaken up to meet the project objectives.

To develop NPV tolerant bivoltine breeds, breeding programme was initiated employing BmNOX as marker utilizing donor parents with high BmNOX expression (Nistari, N2 & 5N) and five recurrent parents (CSR2, CSR4, CSR6, CSR26 & CSR27) of authorized hybrids (CSR2 x CSR4 & FC1 x FC2). The donor parents were crossed with recurrent breeds and the F1s were backcrossed with respective recurrent parents. The digestive juice of BC1 progeny was collected (3rd day/ V instar) and screened individually by SDS-PAGE. The larvae with low BmNOX level were discarded and those with high BmNOX expression were selected and similar strategy was employed in each generation upto BC6. After BC6, the progeny were selfed twice to obtain homozygous lines with high BmNOX expression. Nine combinations each of single hybrids and double hybrids were prepared using the evolved BmNPV tolerant lines. The hybrids including FCs were validated for NPV tolerance in three trials, which were inoculated per orally with 30,000 PIB/ml of NPV at III instar and mortality upto 10 days post inoculation (DPI) was recorded. Based on BmNOX protein marker assisted selection, two lines each of CSR2, CSR4, CSR6, CSR26 and CSR27 with high BmNOX expression were evolved

----- 26 x Nis BC1 ----- --26 x 5N BC1 -- ----- 27 x 5N BC1 -----

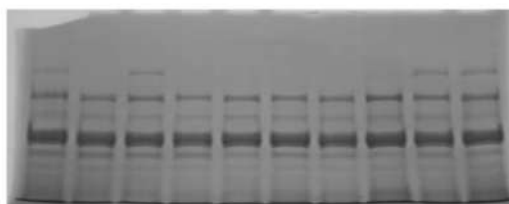
M Nis N2 CSR2 73 78 58 79 81 83 86 90 94 87 97 98 100 101 103 67



SDS-PAGE profile of BC1progeny segregating for differential expression of 26.5 kDa BmNOX protein. Arrows denote individuals with high expression of the protein

-- 2 x Nis BCC6S3 F --- 2 x Nis BCC6S3 M--

1 2 3 4 5 8 9 10 11 12z



SDS-PAGE profile of BCC6S2 selfed progeny. Arrow shows homozygous pattern for BmNOX protein

Evaluation of parental lines and hybrids for tolerance to BmNPV tolerance

Parental Lines	Mortality (%)	Single Hybrids	Mortality (%)	Double Hybrids	Mortality (%)
8	19.00±2.65	8 x 35	11.67±0.58	(8 x 101) x (51 x 75)	10.67±2.08
21	22.33±1.53	8 x 42	11.00±1.73	(8 x 118) x (51 x 87)	11.67±0.58
35	18.67±0.58	8 x CSR4	12.67±1.15	(8 x CSR27) x (51 x CSR26)	14.67±1.53
42	23.00±1.00	21 x 35	8.33±0.58	(21 x 101) x (62 x 75)	12.33±1.53
51	25.33±1.53	21 x 42	10.33±1.53	(21 x 118) x (62 x 87)	8.33±1.15
62	26.67±0.58	21 x CSR4	11.67±0.58	(21 x CSR27) x (62 x CSR26)	9.67±2.08
75	23.67±2.08	CSR2 x 35	8.33±1.53	(CSR2 x 101) x (CSR6 x 75)	12.33±0.58
87	25.00±1.00	CSR2 x 42	11.67±2.08	(CSR2 x 118) x (CSR6 x 87)	9.33±1.53
101	20.67±1.67	CSR2 x CSR4 (C)	21.67± 1.53	FC1 x FC2 (C)	18.33±2.52
118	24.00±1.00				
Nistari	7.33±1.53				
5N	16.33±2.52				
N2	14.67±3.06				
CSR2	52.67±1.15				

- Oval Lines: 8, 21, 101 & 118
- Dumbbell lines: 35, 42, 51, 62, 75 & 87
- 100 larvae/replication in 3 replications were inoculated
- Mock inoculated (distilled water) larvae were control
- Mortality due to nuclear polyhedrosis was recorded 10 DPI

Performance of BmNPV tolerant hybrids based on BmNOX marker assisted selection

Hybrids	Fec.	Yield/10000 larvae		Cocoon wt. (g)	Shell wt. (g)	Shell Ratio (%)	Fil. Length (m)	Denier (d)	Rend-itta	Reela-bility (%)	Neat-ness (p)	
		No.	wt.(kg)									
Single Hybrids	8 x 35	495	8510	13.85	1.621	0.353	21.76	907	2.99	5.73	87.54	96
	8 x 42	476	8460	13.34	1.574	0.342	21.77	852	2.95	5.92	84.12	94
	8 x CSR4	475	8680	13.49	1.551	0.337	21.76	794	3.08	5.78	84.28	96
	21 x 35	496	9020	14.30	1.582	0.343	21.80	916	3.08	5.11	85.51	96
	21 x 42	488	8720	13.73	1.579	0.344	21.84	698	2.93	5.67	84.29	94
	21 x CSR4	466	8920	13.91	1.566	0.335	21.42	862	2.99	5.79	84.28	94
	CSR2 x 35	476	8650	14.33	1.646	0.359	21.78	897	2.92	5.55	87.11	96
	CSR2 x 42	487	8570	13.63	1.576	0.347	22.08	880	2.98	5.80	84.17	94
	CSR2 x CSR4 (C)	469	8130	12.12	1.490	0.325	21.80	921	3.09	5.48	84.28	96
	Mean	480	8629	13.63	1.576	0.343	21.78	859	3.00	5.65	85.06	95
SD	9.88	261	0.657	0.044	0.010	0.167	72.0	0.07	0.24	1.35	1.05	
CV (%)	2.06	3.02	4.818	2.761	2.823	0.765	8.39	2.21	4.29	1.59	1.11	
Double Hybrids	(8 x 101) x (51 x 75)	573	8867	14.09	1.590	0.343	21.57	899	2.73	6.1	85.91	96
	(8 x 118) x (51 x 87)	564	7720	13.55	1.753	0.378	21.59	843	2.81	6.11	87.26	95
	(8 x CSR27) x (51 x CSR26)	551	8680	13.92	1.603	0.366	22.83	921	2.88	5.60	85.78	96
	(21 x 101) x (62 x 75)	584	9093	13.90	1.527	0.330	21.59	945	2.78	5.76	85.78	94
	(21 x 118) x (62 x 87)	591	8987	15.21	1.693	0.359	21.24	966	2.95	5.59	85.56	96
	(21 x CSR27) x (62 x CSR26)	581	9147	15.02	1.639	0.361	22.03	846	2.72	6.17	85.54	96
	(CSR2 x 101) x (CSR6 x 75)	562	8547	13.41	1.571	0.333	21.14	848	2.97	5.90	86.07	96
	(CSR2 x 118) x (CSR6 x 87)	547	8453	14.94	1.762	0.379	21.53	952	2.86	5.86	87.34	96
	FC1 x FC2 (C)	575	8173	13.09	1.602	0.357	22.27	920	2.97	5.79	84.07	96
	Mean	570	8630	14.13	1.638	0.356	21.75	904	2.85	5.88	85.92	96
SD	14.76	467	0.763	0.081	0.018	0.534	48.2	0.10	0.22	0.97	0.71	
CV (%)	2.59	5.41	5.398	4.974	4.976	2.457	5.33	3.45	3.67	1.13	0.74	

Based on the overall performance for the pre- and post-cocoon traits including BmNPV tolerance, single hybrid (21 x 35) and two double hybrids (21.118 x 62.87 & 21.CSR27 x 62.CSR26) have been short-listed for further evaluation under OST during 2015-16 at RSRs.

REARING TECHNOLOGY & INNOVATION

Concluded Activities

Popularization of rotary mountages for quality cocoon production (Apr. 2013 - Mar. 2015)

Eriko Kawaguchi, JICA Expert and S. Purushotham

Objective: To popularize rotary mountages for creating awareness among bivoltine rearers for quality cocoon production

An extensive survey was conducted in Andhra Pradesh, Karnataka and Tamil Nadu along with JICA expert, Ms. Eriko Kawaguchi to collect the feedback from sericulturists for non adoption of rotary mountage technology for quality cocoon production. To re-disseminate the technology, farmers were advised to follow nylon net collection method for collection of 50% of mature larvae to reduce drudgery during the spinning and were also advised to mount 50% of mature worms on rotary mountages and the remaining on plastic collapsible mountages. JICA supplied rotary mountages, nylon net and harvesters to 12 clusters (4 each in southern states) for the demonstration and quality cocoon production. About 370 farmers were sensitized on use of rotary mountages and nylon net collection method.

Multiplication of parental stocks of newly developed hybrids and evaluation

Seven multivoltine and bivoltine breeds/hybrid rearings (790 dfls) were conducted and 3.08 lakh seed cocoons were supplied to the Grainage unit.

Rearing Performance							
Crop Season	Breed /Hybrid	Dfls (No.)	ERR (No.)	SCW (g)	SSW (g)	SR (%)	Pupation (%)
Mar.-Apr.	L14	130	9338	1.281	0.225	17.56	91.22
May-Jun.	L14	100	9222	1.382	0.246	17.80	95.31
Jul.-Aug.	L14	130	9143	1.512	0.269	17.69	96.66
	Total/Avg.	360	9234	1.391	0.246	17.68	
Sep.-Oct.	G11	30	9698	1.589	0.370	23.28	93.32
	G19	30	9574	1.671	0.384	22.98	87.52
	FC3	30	9446	1.776	0.418	23.53	86.00
	FC4	30	9415	1.830	0.432	23.60	87.79
	Total/Avg.	120	9533	1.717	0.401	23.35	
Nov.-Dec.	S8	20	9621	1.428	0.338	23.67	90.45
	CSR16	20	9618	1.538	0.333	21.65	93.58
	G11	15	9465	1.78	0.397	22.33	94.07
	G19	15	9439	1.619	0.354	21.86	94.00
	Total/Avg.	70	9536	1.591	0.356	22.37	
Jan.-Feb.	FC3	75	5747	1.652	0.361	21.85	80.14
	FC4	75	8251	1.783	0.392	21.98	80.26
	Total/Avg.	150	6999	1.72	0.38	21.92	
Mar-Apr.	ICB-I	50	7813	1.654	0.348	21.03	81.35
	ICB-II	50	8351	1.868	0.398	21.30	82.50
	ICB-III	50	9098	1.736	0.362	20.85	80.00

GRAINAGE

Production of hybrid dfls for popularization of authorized and newly developed silkworm hybrids

R. Bhagya

A total quantity of 43,079 bivoltine hybrid dfls were produced utilizing 2,37,609 seed cocoons for OFT in South India under research projects AIB-3488, AIB-3498 & AIB-3521 including 7200 dfls (FCs) and 706 dfls (P1). The grainage performance of different hybrid combinations was recorded. 1400 dfls of

Hybrids	Batches (Nos)	Seed Cocoons (No.)	Pupation Rate (%)	Eggs /g (Nos)	Dfls Produced (Nos)	Egg Yield (g/kg)
CSR50 x CSR51	4	85980	88.78	1809	12725	55.58
CSR16 x CSR17	4	51283	86.97	1814	8880	61.95
FC3 x FC4	4	53836	91.33	1786	11250	57.19
S8 x CSR16	2	13904	92.02	1730	3050	65.46
G11 x G19	4	32126	92.28	1772	8400	68.24
Total/Avg.	18	237129	90.27	1782	44305	61.68

L14 x CSR2 were produced with a pairing percentage of 30.42, egg yield of 82.24 g/kg seed cocoons and average eggs/g was 1797. These hybrids were distributed to the farmers under different programmes.

Alternate techniques for loose egg preparation to improve of grainage operations (Pilot study)

S. B. Kulkarni (PI) and R. Bhagya

Objective: To test comparted frames for moth emergence and nylon nets for egg laying	Particulars	Comparted frames	Control
	Trays required 2x 3' (Nos)	20	12
	Pupae kept /tray (Nos)	312	500
Outcome: It helps to save time and avoids dependency on skilled workers for sexing and drudgery. Plastic sheets can be easily cleaned and reusable (20-30 times).	Total pupae kept (Nos)	6240	6240
	Time taken to keep frames by 2 persons in tray (min)	20	0
	Time to sex the pupae by 2 persons (min)	0	225
	Time to keep the pupae by 2 persons in frames (min)	60	10

POST COCOON EVALUATION UNIT

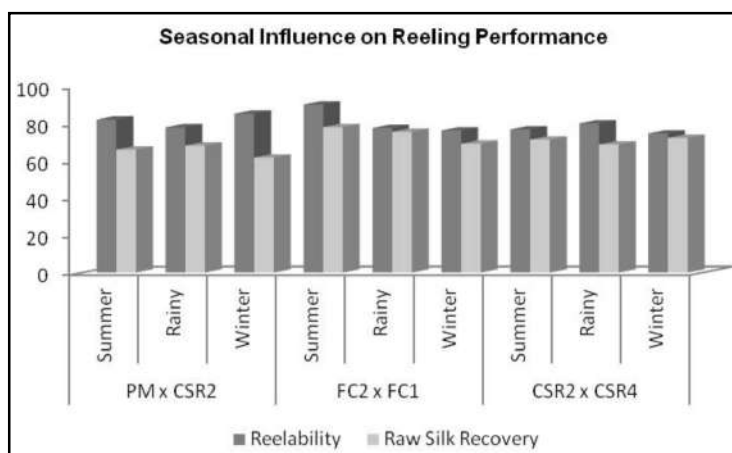
Continuous/Other Activities

Evaluation of newly developed silkworm hybrids for post cocoon parameters

Y. C. Radhalakshmi (PI) and Kariyappa

Objective: To evaluate the post cocoon parameters of newly developed breeds/hybrids

Cocoon lots (649) of various hybrids from different units of institute and its nested units were evaluated regularly for the reeling performance. The data is documented and analysed across test centres and seasons. The data on reeling performance would help the breeders to suggest suitable rearing package of practices and to plan future breeding programmes to improve post-cocoon traits and silk quality. The influence of seasons on the reelability and raw silk recovery was analysed for popular crossbreed (PM x CSR2) and bivoltine double (FC2 x FC1) and single (CSR2 x CSR4) hybrids with pronounced effects in rainy season.



Region-wise comparison of reeling data of silkworm hybrids

Hybrid	Location	Lots	Reelability (%)	AFL (m)	NBFL (m)	Denier (d)	Raw Silk (%)	RSR (%)	Neatness (p)
PM x CSR2	Anantapur	1	88.41	519	459	2.53	11.15	57.34	84
	Salem	3	81.39	729	593	2.75	13.16	67.92	88
	Vikarabad	2	76.54	664	508	2.70	11.85	65.02	86
L14 x CSR2	Anantapur	1	83.66	598	500	2.33	13.02	63.96	83
	Salem	3	80.13	904	724	2.57	14.27	67.26	88
	Kodathi	1	87.46	714	624	2.67	12.24	61.11	89
	Vikarabad	2	83.10	824	685	2.80	15.23	70.88	87
L14 x CSR50	Anantapur	1	79.15	633	501	2.45	12.66	70.25	87
	Salem	3	84.04	894	750	2.64	15.36	71.07	87
	Vikarabad	2	87.08	834	726	2.96	14.81	70.97	86
NDV6 x CSR51	Anantapur	1	87.26	662	577	2.47	14.61	66.86	85
	Salem	3	83.32	925	768	2.57	14.90	69.21	88
	Vikarabad	2	86.70	888	770	2.93	14.42	71.55	88

Hybrid	Location	Lots	Reelability (%)	AFL (m)	NBFL (m)	Denier (d)	Raw Silk (%)	RSR (%)	Neatness (p)
FC1 x FC2	Salem	1	91.87	884	812	2.49	14.59	65.05	95
	Kodathi	1	75.44	598	449	2.65	14.79	73.61	93
	Ch.Nagar	1	82.11	752	617	3.08	16.71	71.06	94
FC2 x FC1	Vikarabad	1	76.36	899	684	2.72	15.38	69.30	94
	Salem	2	84.09	1075	899	2.54	16.94	76.92	95
G11 x G19	Vikarabad	1	82.23	934	766	2.89	16.18	78.81	96
	Kodathi	1	75.23	644	480	2.49	14.31	70.85	96
	Salem	1	66.35	746	483	2.70	13.83	64.00	94
CSR2 x CSR4	Salem	3	75.60	822	601	2.60	15.60	70.06	95
	Kodathi	1	70.09	644	449	2.53	14.09	72.60	94
	Ch.Nagar	1	87.67	895	785	2.81	17.03	70.36	94
	Vikarabad	1	79.37	880	697	2.67	14.76	72.00	96
2C x 4S	Kodathi	1	74.53	590	431	2.50	13.50	65.65	95
	Salem	1	70.34	756	519	2.63	13.92	62.43	95
	Vikarabad	1	75.47	884	665	2.72	16.38	75.22	96

Field trial of reeling package to reel L14 x CSR2 cocoons (Apr. 2014 to Mar. 2015)

Kariyappa (PI) and Y. C. Radhalakshmi

Objective: To demonstrate the reeling package for L14 x CSR2 cocoons in the field

The robustness and shell properties of L14xCSR2 cocoons are neither normal multi x bivoltine cocoons and nor bivoltine cocoons. Even though the cocoons of hybrid are being transacted at higher rate due to improved fibre characteristics, it is reported that these cocoons are not been performing up to the expectation in the process of reeling. This may be due to several factors process methods including technical/managerial factors. A reeling package exclusively for L14xCSR2 cocoons was developed, which includes standardised reeling processes like method of stifling, cooking etc. to produce quality silk. As the institute is focusing on popularising L14x CSR2 in the field, validation of the specific package through field trials was undertaken for fine tuning and demonstration in the field at Sidlaghatta (SDL) and Kollegal (KOL). The newly developed package was compared with the existing procedures. The reeling package modified for L14xCSR2 revealed improved renditta and raw silk recovery, which has direct impact on productivity.

Reeler	Place	SCW (g)	SSW (g)	Shell Ratio (%)	Lot Wt.(kg)	Reelability (%)	Renditta	Raw Silk (%)	Silk Wt. (kg)	RSR (%)	Waste (%)
Mastan	SDL	1.859	0.368	19.80	51	89.20	7.18	13.92	7.10	75.82	15.49
S. R. Ahamad	SDL	1.897	0.389	20.51	98	87.65	7.09	14.11	13.82	79.80	15.92
Anjanappa	SDL	1.698	0.316	18.61	87	85.48	7.23	13.84	12.10	73.11	14.88
N. Murthy	SDL	1.880	0.359	19.10	43	86.32	7.12	14.04	6.07	74.35	15.17
Venkatesh	KOL	1.994	0.445	22.32	106	90.04	6.79	14.73	15.68	80.52	15.63
Abdul Zahir	KOL	1.891	0.411	21.73	145	77.91	7.11	14.07	10.96	78.90	14.42

Test reeling of experimental lots for reeling performance

Y. C. Radhalakshmi and Kariyappa

Cocoons of newly evolved races/breeds/hybrids (775 lots) from different laboratories of main institute and its nested units were test reeled and post cocoon parameters were analyzed. The unit also processed 21 raw silk samples of different sources were reeled on multiend machine and graded at SCTH, CSTRI-Bangalore. Further, a total of 436 Kg. of cocoons were stifled, conditioned, cooked and reeled and 44 kg of raw silk was produced. Thirty commercial cocoon lots from CPP cluster (Karnataka and Tamil Nadu) were processed and reeling performance of the bivoltine hybrids was documented. The data reveals that reelability ranged around 80-82%; average filament length (830-1030m); denier (2.72-2.94); renditta (6.2-7.0); raw silk recovery (70-80%); and neatness of 94-95 points.

SILKWORM PHYSIOLOGY

Continuous Activities

Maintenance of bivoltine and multivoltine silkworm diet breeds for original breed characteristics (Apr. 2009 to Mar. 2019)

M. Munirathnam Reddy

Objective: To maintain artificial diet silkworm breeds conforming to the original breed characteristics

Two rearings of bivoltine semi-synthetic diet breeds were conducted for pre- and post-cocoon characteristics. Feed response ranged between 91.24 and 95.92, pupation rate (86.24 & 93.62) and the performance of breeds was in conformity with the original characteristics. Similarly, six rearings of multivoltine semi-synthetic diet breeds were conducted and the feed response was between 90.42 and 96.26, pupation rate (86.68 & 90.74) and the performance was in conformity with the original breed characteristics.

BV	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)
MV	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)

Application of probiotics for improving economic characters of silkworm (Apr. 2013 to Mar. 2015)

M. Munirathnam Reddy

Objective: To study the effect of probiotics for improvement of economic characters of *Bombyx mori*

Probiotics are live microbial food supplements beneficially affecting host by enhancing cellular growth and development. The effect of *Streptomyces noursei*, a known probiotic for improvement of economic parameters of *Bombyx mori* was undertaken. Standard culture of *S. noursei* (NCIM 2083; National Collection of Industrial Micro-organisms, National Chemical Laboratory, Pune) was cultured in

Effect of probiotics on economic characters of silkworm hybrids

Silkworm Hybrids	Probiotics Dose (cfu/ml)	Ten Larval Wt. (g)	Pupation Rate (%)	Single Cocoon Wt.(g)	Single Shell Wt. (g)	Shell Ratio (%)
CSR2 x CSR4	Control	43.0	84	1.543	0.312	20.2
	10 ⁴	45.0	89	1.569	0.320	20.4
	10 ⁶	48.0	95	1.809	0.375	20.7
	10 ⁸	47.0	93	1.798	0.362	20.1
PM x CSR2	Control	40.5	82	1.263	0.213	16.88
	10 ⁴	43.0	85	1.281	0.219	17.09
	10 ⁶	46.0	92	1.289	0.239	18.54
	10 ⁸	42.0	88	1.258	0.211	16.77

MGYP broth medium. The broth cultures (10⁴cfu/ml, 10⁶cfu/ml & 10⁸cfu/ml) were supplemented on leaves of V1 variety and fed to popular bivoltine and multivoltine silkworm hybrids (first feeding after 48 hours of V instar larvae; 300 larvae/treatment in 3 replications). The control group was fed with MGPY broth treated leaves. Growth and development parameters of silkworm were recorded and analyzed. The commercial characteristics of silkworms were significantly enhanced by probiotic supplement.

PEST MANAGEMENT LABORATORY

On-Going Research Projects

PRE-3527: Survey and Surveillance of major pests and their natural enemies in mulberry eco-system (Jan 2015-Dec 2016)

J. B. Narendra Kumar (PI), Vinod Kumar, M. Noble Morrison¹, H. Jairam², S. N. Pallavi³, N. Sakthivel⁴, S. Mahiba Helen⁵ and B. Kasi Reddy⁶

¹REC, Madivala, ²REC SU, Kanakapura, ³RSRS, Chamarajanagar, ⁴REC SU, Srivilliputhur, ⁵RSRS, Salem, ⁶RSRS, Anantapur

Objectives:

- To monitor the incidence of insect pests and their natural enemies in mulberry eco-system
- To construct life tables and study tri-trophic interaction of new pests, if any and their natural enemies
- To establish cultures of new potential natural enemies for mulberry pests

Incidence of mealybug (0.8-7.4%), leaf roller (0-18.4%), thrips (0.3-5.29/leaf) and whitefly (0-18.7/leaf) was recorded in selected areas of Karnataka (Mysore, Chamaraajanagar, Kanakapura and Kolar), Tamil Nadu (Salem & Srivilliputtur) and Andhra Pradesh (Anantapur). A new parasitoid of leaf roller, *Phenerotoma* sp. was found to parasitize the roller pest in Karnataka and Tamil Nadu to an extent of 42% and 36%, respectively. Besides, three species of coccinellids, one species of parasitoid on whitefly and one species of predatory thrips were collected at RSRS, Salem and the same were sent to NBAIR, Bangalore for identification.

ARE-3526: Investigation on semio-chemicals of the silkworm uzi fly *Exorista bombycis* (in collaboration with NBAIR, Bangalore (Jan 2015-Dec 2016)

Vinod Kumar (PI), J. B. Narendra Kumar, M. Noble Morrison¹, N. Bakthavatsalam (PI)² and Subhaharan

¹REC, Madivala, ²NBAIR, Bengaluru

Objectives:

- To isolate and identify the kairomones from mulberry leaf, silkworm larva, faecal matter and exuvium eliciting behavioural response in uzi fly
- To isolate and identify the sex pheromones of *E. bombycis*
- To determine the bio-efficacy of kairomones (mulberry) and sex pheromones (uzi fly)

Timely supply of uzi pupae to NBAIR for achieving uzi fly emergence was ensured. Abdominal extract of *E. bombycis* was collected and subjected to GC-MS at NBAIR and compounds identified were Azetidinecarboxaldehyde, Nananol, Phenyl propanoic acid, Hexadecenal and Chloro hexadecenal. In the entrapment method, Trimethyl bicycle hept-2 was identified and further work is under progress.

ToT Activities

Demonstration of uzi fly management strategies in an adopted village of Srirangapatna taluk (Jun. 2013 to May 2014)

Vinod Kumar and J. B. Narendra Kumar

Objective: Demonstration of uzi fly management

IPM package (release of ecto-pupal parasitoid, *Nesolynx thymu* + placement of uzi trap + packing of silkworm litter to kill uzi pupae) was demonstrated covering all the sericulturists (167) in Chikkaharohalli village in Srirangapatna Taluk. A total of 1932 pouches of *N. thymus* were released covering 94,965 dfls in 783 crops. Uzi traps inside and outside the rearing houses

Months	Crops (No.)	Dfls (No.)	<i>N. thymus</i> Release (pouches)	Trapped Uzi flies (No.)	Uzi infestation (%)
July 2013	77	10890	232	4136	2.20
Aug.	37	4735	101	3046	1.60
Sept.	45	6355	128	3267	1.90
Oct.	84	10110	208	3955	1.40
Nov.	56	7325	145	2153	1.10
Dec.	69	7440	150	1434	1.00
Jan. 2014	114	13500	264	1933	1.10
Feb.	96	11625	236	2507	0.93
March	53	6350	108	1023	0.72
April	45	4705	115	629	0.13
May	107	11930	245	1136	0.43
Total/Avg.	783	94965	1932	25219	1.14

were able to trap 25,219 uzi flies. IPM package resulted in reduction of uzi fly incidence to 1.14% from 10.7%.

Continuous/Other Activities

Maintenance of mother culture for production of recommended bio-control agents and mass release of recommended bio-control agents of sericultural pests in CSRTI campus

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

Objective: Maintenance of mother culture of bio-control agents and release in CSRTI campus

Nucleus cultures of five parasitoids namely *Nesolynx thymus*, *Exoristobia philippinensis*, *Trichomalopsis uziae*, *Trichopria* sp. and *Dirhinus* sp., two predators of mealy bug i.e., *Cryptolemus montrouzieri* and *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. A total of 4,117 pouches of *Nesolynx thymus*, 1,46,250 *Scymnus* beetles (585 boxes) and 366 Tricho-cards were produced. 1,110 pouches (111 lakh adults) of *N. thymus*, 39,250 predatory beetles (157 boxes) and 301 Tricho-cards were released in CSRTI campus, which resulted in keeping pest incidence below 5%.

Release of multiple parasitoids to reduce uzi fly population in cocoon markets, grainages & reeling units

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

Objective: Reduce the population of uzi fly in cocoon markets, grainage and reeling units

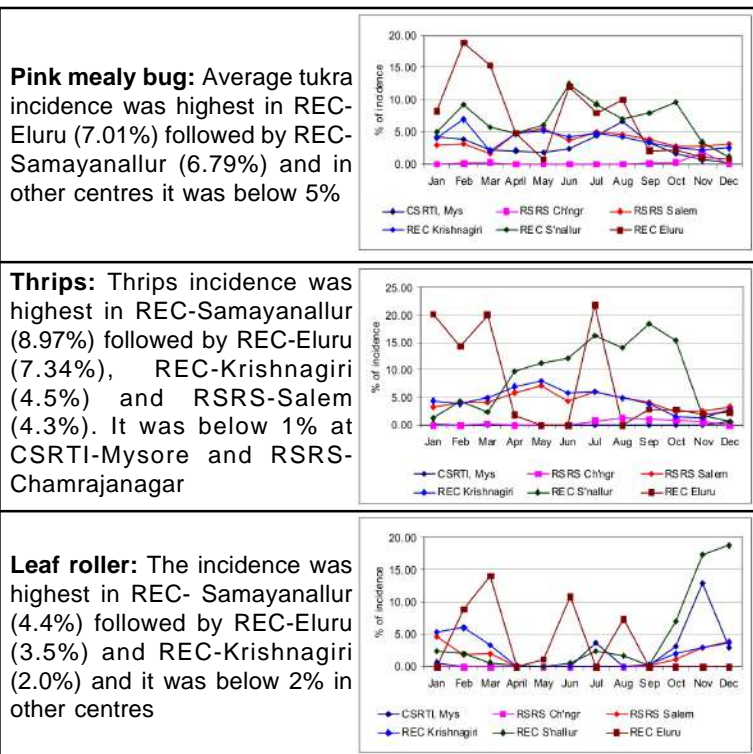
Release of *Nesolynx thymus* (gregarious) and *Dirhinus* (solitary) pupal parasitoids of uzi fly in cocoon markets (Ramanagaram, Channapatna & Kollegal), three reeling units (Ramanagaram) and grainages (SSPC- Ramanagaram, RSP, Ramanagaram & GMG- Channapatna) at fortnightly interval for a period of 6 months was carried out @ 10 pouches *N. thymus*/centre and 1,000 adults of *Dirhinus*/centre. Old uzi pupae were collected from locations to record establishment of natural enemies and *N. thymus* established in all the nine centres. However, *Dirhinus* failed to establish in any of the centres. Further, the uzi fly emergence was below 10% after release of bio-control agents. In cocoon markets of Ramanagaram and Channapatna, another parasitoid *Trichopria* sp. was also found and proportion of *Trichopria* was more as compared to *N. thymus*.

Forewarning and forecasting of mulberry pests

Mary Josepha Shery A.V. (PI), J. B. Narendra Kumar, M. Noble Morrison, K. Srikantaswamy, A. Gnanakumar Daniel, S. Balasaraswathi, S. Masilamani, M.Venkateswara Rao and M. A. Shanthan Babu

Objective: To make the control strategies for mulberry pests

Fortnightly survey on prevalence of pests in mulberry gardens and silkworm rearings at CSRTI-Mysuru and nested units (RSRS-Chamarajanagar, REC-Madiwala, RSRS-Ananthapur, REC-Eluru, RSRS-Salem, REC- Krishnagiri & REC-Samayanalloor) was conducted and data was analyzed. Forty-five weekly forewarnings of Seri-Agromet advisory were uploaded through Silk Portal for Sericulture farmers (West Godavari & Srikakulam in Andhra Pradesh; Nalgonda and Medak in Telangana).



SILKWORM PATHOLOGY

Concluded Projects

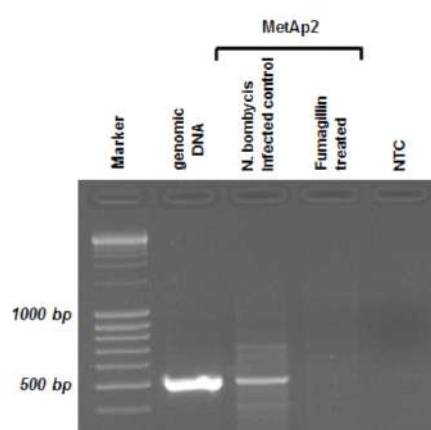
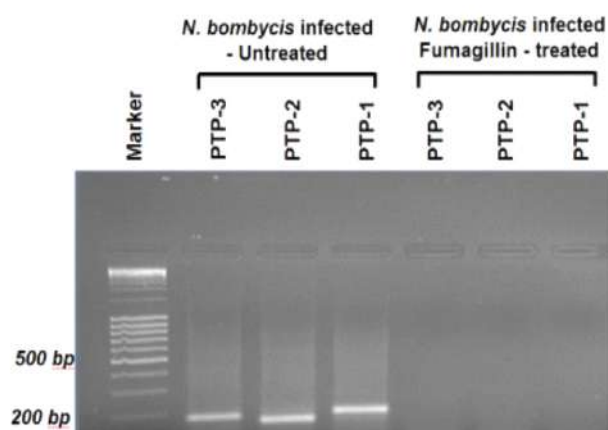
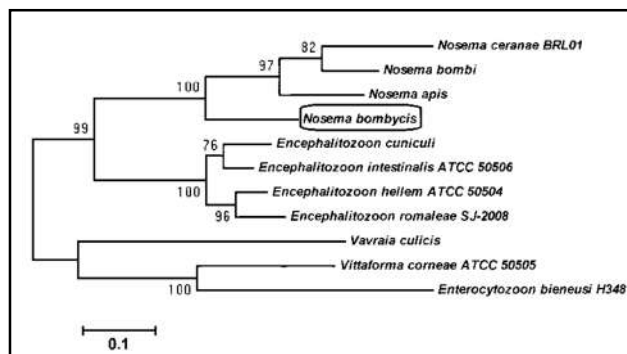
APR 3477: Therapeutic control of Microsporidiosis in the silkworm through characterization of Methionine Amino Peptidase enzyme genes (MetAP2) in *Nosema bombycis* (Apr. 2012 to Mar. 2015)

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 for *Nosema bombycis*
- The cloning and characterization of MetAP2 gene of microsporidia
- Development of a process controlling microsporidiosis using certain chemical compounds in the silkworm

Nosema bombycis spores were multiplied by inoculation to the susceptible silkworm breed and purified using standard protocols. Degenerative primers were designed for of *N. bombycis* and the MetAP2 gene was amplified, cloned and sequenced. DNA isolated from purified microsporidian spores was used for PCR. Six chemicals including fumagillin targeting MetAP2 gene of *N. bombycis* were evaluated. The phylogenetic analysis of *N. bombycis* MetAP2 showed similarity with *N. ceranae* MetAP2. Anti-microsporidial activity was effective with fumagillin against MetAP2 gene expression and suppressed *N. bombycis* multiplication.



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)

M. Balavenkatasubbaiah (PI), K. Chandrasekharan and A.R. Narasimha Nayaka, M. Maheshwari (RSRS-Bangalore), N. Sivashankar (RSRS- Bangalore), V.B. Mathur (REC SU - Maddur), S. Rajkumar (RSRS-Salem), T. Thirunavukkarasu (REC- Gobi), N.G. Selvaraju (REC SU- Trichy), B. Kasi Reddy (REC-Madakasira), P. Venkata Ramana (REC- Vikarabad; up to May 2013), B. Narasimha Murthy (REC- Vikarabad; from June, 2013), M. Venkateswara Rao (REC- Eluru) and T. M. Mogili (REC- V. Kota from July, 2013 onwards)

Objectives:

- To determine the silkworm diseases incidence in the Southern Sericultural states viz., Karnataka, Tamil Nadu and Andhra Pradesh
- To estimate the extent of crop loss due to the silkworm diseases in the field
- To identify the factors responsible for crop loss and their impact on cocoon productivity

Fortnightly surveys on the silkworm disease prevalence in three southern states viz., Karnataka (Bangalore Rural, Kolar & Mandya), Tamil Nadu (Salem, Erode & Tirupattur), Telangana (Ranagreddy) and Andhra Pradesh

(Anantapur, West Godavari & Chittoor) were conducted from October, 2012 to September, 2014. The survey covered five farmers with V instar larvae (4th - 6th day) were randomly selected in each area. Total number of larvae /sq ft/ bed area and total number of larvae in the rearing bed were determined. 10% of the bed area/trays were observed for the incidence of silkworm disease viz., Grasserie, Flacherie, Muscardine and Pebrine based on visual symptoms and microscopic examination and the disease incidence was recorded. After completion of crop, information on yield was collected from the farmer. Possible reasons for crop loss from farmers having less than 60 kg cocoon yield/100 dfls were documented and the data was analyzed. The seasonal incidence of grasserie, flacherie and muscardine was documented. Only 18.63% crops yielded <60kg, while the rest yielded >60kg. The low cocoon yield (<60 kg /100 dfls) was mainly attributed to poor quality of leaf (8.08%) followed by high temperature and high humidity (4.49%), poor rearing management (1.64%) and poor hygiene (1.56%).

Month	Disease Prevalence (%)			Yield/ 100 dfls (kg)
	Grasserie	Flacherie	Muscardine	
Oct. 2012	2.75	2.47	0.00	67.57
Nov. 2012	1.53	1.91	0.45	67.15
Dec. 2012	1.34	1.63	0.47	68.51
Jan. 2013	1.33	1.45	0.72	69.77
Feb. 2013	1.85	1.31	0.22	68.80
Mar. 2013	2.66	1.42	0.06	65.56
Apr. 2013	3.14	1.70	0.02	62.97
May 2013	1.91	1.70	0.00	63.13
Jun. 2013	0.93	1.11	0.08	67.33
Jul. 2013	0.97	1.76	0.15	66.07
Aug. 2013	1.02	1.30	0.02	67.57
Sep. 2013	0.94	1.42	0.01	70.48
Oct. 2013	0.88	1.59	0.02	68.96
Nov. 2013	0.92	1.15	0.33	68.94
Dec. 2013	0.53	0.98	0.49	69.85
Jan. 2014	0.74	1.20	0.25	71.14
Feb. 2014	0.56	1.09	0.10	72.22
Mar. 2014	0.83	1.35	0.09	66.66
Apr. 2014	1.73	1.16	0.04	65.28
May 2014	0.79	0.84	0.04	67.36
Jun. 2014	0.96	1.29	0.01	66.09
Jul. 2014	0.65	1.75	0.05	66.15
Aug. 2014	0.58	1.67	0.09	66.57
Sep. 2014	0.74	1.53	0.01	68.36
Average	1.26	1.45	0.15	67.60

ARP 3519: Silkworm Disease Monitoring of Seed and Commercial Crop Rearing of South Indian States (Oct. 2014 to Mar. 2018)

M. Balavenkatasubbaiah (PI), A.V. Mary Josepha and M. Ramesh Babu¹

¹NSSO, Bangalore and One Scientist from each BSF and Cluster

Objectives:

	Seasonal prevalence of silkworm diseases					
	State	Season	Grasserie	Flacherie	Muscardine	Cocoon Yield/100 dfls
● To estimate the prevalence of silkworm diseases at selected Basic Seed Farms and Commercial Crop rearings (CPP Clusters) in the South Indian states	Karnataka	Summer	1.20	1.85	0.10	71.14
		Rainy	0.85	2.29	0.07	71.55
		Winter	1.02	2.32	0.40	71.37
● To suggest remedial measures on spot to the farms/farmers to manage the silkworm diseases and to prevent disease outbreak	Tamil Nadu	Summer	0.55	1.34	0.00	63.77
		Rainy	0.48	1.30	0.00	67.64
		Winter	0.34	0.94	0.00	71.07
Silkworm disease monitoring was initiated from January, 2015 onwards in selected Basic Seed Farms from Karnataka, Tamil Nadu and Andhra Pradesh and also in selected Cluster areas of Karnataka, Tamil Nadu, Andhra Pradesh, Telangana, Kerala and Maharashtra. Crop-wise disease monitoring will be conducted in all the breeds reared throughout the year in BSFs, whereas monthly (10 farmers crops) monitoring on the incidence of silkworm diseases will be conducted in the selected CPP clusters. A web based data entry sheet was uploaded for submission of crop inspection report by each team leader (CSB-CDF) along with remedial measures suggested and follow up action taken. The incidence of diseases from January, 2015 to March, 2015 in each BSF/cluster of each state was recorded.	AP	Summer	2.88	0.75	0.02	61.91
		Rainy	1.72	1.42	0.06	64.10
		Winter	1.79	0.74	0.66	66.22
Average	Average	Summer	1.62	1.28	0.04	65.39
		Rainy	1.08	1.65	0.05	67.44
		Winter	1.09	1.30	0.37	69.38
		Average	1.26	1.45	0.15	67.40

Average disease incidence in CPP clusters in South Zone

State	Crop	Dfls (Nos)	Disease incidence (%)								Yield /100 dfls(kg)	Coc. /kg
			Inspection (V instar)				Farmer Assessment (completion of crop)					
			Gra	Fla	Mus	Peb	Gra	Fla	Mus	Peb		
Karnataka	BV	8200	0.10	4.79	0.00	0.00	0.04	2.98	0.00	0.00	61.14	591
Tamil Nadu	BV	442015	0.05	0.10	0.02	0.00	0.11	0.16	0.03	0.00	76.84	555
Andhra Pr'sh	BV	18500	0.14	1.25	0.42	0.07	0.14	1.47	0.46	0.00	65.74	611
Telangana	BV	2000	0.62	0.80	0.00	0.00	1.43	1.52	0.00	0.00	66.56	628
Maharashtra	BV/CB	9300	0.37	0.22	0.29	0.00	1.90	0.72	0.84	0.00	63.81	641

Continuous/Other activities

Pebrine monitoring: Sporadic incidence of microsporidian was noticed in Pure Mysore seed area (Kunigal and Magadi) from July, 2014 to September, 2014. A joint committee comprising of CSRTI, -Mysore, NSSO-Bangalore, KSSRDI- Bangalore and DoS-Karnataka conducted microscopic examination of different samples (silkworm eggs, larvae, pupae, moth, dust and faecal matter) samples from all the Grainages, Basic Seed Farms, Cocoon Markets and farmers crops and eliminated the microsporidian infected batches. The testing was conducted in two spells (July-August 2014 and September 2014). During the first spell, 2 samples (0.71%) revealed the infection out of 282 samples and in the second spell, 44 samples (1.32%) revealed infection out of 3,339 samples tested. Mass disinfection program was conducted in the entire Mysore Seed area and the incidence of microsporidian infection was brought under check. Field staff/Registered Seed Producers/Registered Chawki rearers/farmers were educated through Workshops/Training programs/Group discussions on the control of pebrine disease. A Hand book on Pebrine Control and Management in Kannada language for the benefit of the staff and farmers was prepared. The microsporidian infested crop from Mysore Seed Area was reared for four successive generations and found that the microsporidian is virulent and transmits transovarially. Pebrine monitoring was also conducted in other sericultural areas of Karnataka and laboratories of CSRTI-Mysore, P4BSF-Hassan and P3 BSF-Mysore (NSSO and the incidence was kept under check.

Quality analysis Reports: Twenty six quality analysis certificates were issued for Asthra, Ankush Green, Rainbow Vijetha, Nandi Amruth, Vetcare Vijetha, Vetcare Vijetha Supplement, Serichlor and Rainbow Ankush, Vijetha Gold.

Forewarnings for silkworm diseases: A forewarning on flacherie disease and its management was issued through CSRTI- Website. A total of 53 weekly Seri-Agromet advisories Bulletins (April, 2014 to March, 2015) were issued through Silk Portal. SMS messages were prepared for sericulturists on the management of silkworm diseases in six languages and issued under mKISAN.

SERICULTURAL ENGINEERING DIVISION

The Sericultural Engineering Division is pioneer in design and development of various kinds of tools, equipments and machines for mechanization for various mulberry sericulture activities in India. The machines/tools developed are in high demand and form major component in development programmes implementing agencies. The Division is actively involved in design and development of rearing houses for young and late-age silkworms. The major R&D activities, training, extension, publication etc. are as follows:

Design and Development of Equipments and machines for sericulture

Cocoon harvester for collapsible plastic mountages: The cocoon harvester design was improved for higher efficiency, easy operation and maintenance. The machine was rigorously tested at institute and farmers level. The prototype was developed for commercial production and assigned to NRDC, New Delhi for patenting and commercialization. M/S Raj



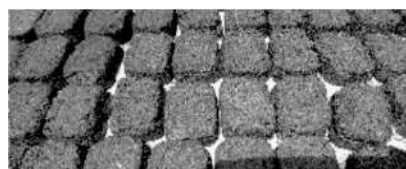
Enterprises, Mysore and M/S SKB Systems, Coimbatore were licensed through NRDC for commercial production of cocoon harvesters.



Design and Development of Mechanized Rearing Beds for Late-Age Rearing of Silkworms: Mechanized Rearing Bed design for late-age rearing of silkworms to reduce manpower requirement were improved. An auto-controller for forward and return

of dusting unit and shoot transport platform was developed and tested.

Energy from mulberry shoots: A large quantity of mulberry shoots are discarded after silkworm cocooning and harvest. CSRTI Mysore has embarked research on effective utilisation of mulberry shoots by converting them into energy and combustion efficient bio-fuels like briquettes and charcoal.



Design and development of silkworm rearing houses for hot & dry and hot & humid climatic zones of peninsular India: Sericulture has gained ground and popularity in hotter regions of Karnataka, Andhra Pradesh and Tamil Nadu; and hot and humid regions of coastal Andhra Pradesh. The rearing house requirements of non-traditional areas are being studied to design and develop new rearing house design for undertaking sericulture activities successfully.

Patenting	
Invention	Patent Details
A Machine for application of slaked lime and bed disinfectant powders over young-age silkworms (Chawki worm dusting machine)	No: 1712/CHE/2015 Date: 31/03/2015
Seri Heater	No: 1711/CHE/2015 Date: 31/03/2015
PVC stands for rearing young-age silkworm (Chawki Rearing Stand)	No: 1645/CHE/2015 Date: 30/03/2015

Commercialization	
Machine/ Equipment	Firm
PVC stands for rearing young-age silkworm (Chawki Rearing Stand)	M/S Concept Components Mysore
Cocoon harvester for collapsible plastic mountages	M/S Raj Enterprises Mysore; M/S SKB Systems Coimbatore
Matured worm separator	M/S Das & Kumars Varanasi

Training: A total of 1263 trainees were imparted different aspects of mechanization in sericulture and silkworm rearing houses. Around 6500 farmers, students, reelers, etc. visited the division to acquire information.

Fabrication & Supply: Six units (Tray washing machines: 2 units @ Rs. 32,000/unit; Mulberry Cutting preparation machine: 2 units @ Rs.11000/unit; Plastic moutage folding tool: 2 units @ Rs. 250/unit) of sericulture equipments and machines of Rs. 1.99 lakh value were fabricated and supplied to farmers and sericultural R&D institutions and organisations.

SERICULTURE EXTENSION, ECONOMICS AND MANAGEMENT

Ongoing Research projects

MOE 3525: A Study on the impact of pest and disease management practices in sericulture among the farmers under cluster promotion programme in South India (Jan. 2015 to Dec. 2016)

B. Gangadhar, H. Jayaram T. Mogili, G. Punithavathi and Ramprakash

Objectives:

- To study the impact on the adoption level of management practices for pest and disease of mulberry and silkworm under CPP area
- To study the constraints in adoption of pest and disease management practices

A total of 17 CPP clusters were selected from Southern Zone and Maharashtra and 50 sericulturists were selected from each cluster through multi-stage random sampling method. Interview schedule has been developed and pretested.

MOE 3523: Study on Drought Management practices in Mulberry Sericulture (Jan. 2015 to Dec. 2016)

Mahima Santhi, M. Noble Morrison K. Vedavyasa, M. P. Reddy, B. Vidyunmala, A. Gnanakumr Daniel and B. Mohan

Objectives:

- To analyse different management practices adopted by farmers to overcome the crisis of drought in mulberry cultivation and silkworm rearing.
- To study the adoption level of scientific drought management techniques popularised by the research institutes and to rectify the gaps.
- To study the preferences and expectations of farmers from research and extension scientists to overcome the crisis effectively

The project is being implemented in six clusters viz Tumkur & Ithandahally (Karnataka); Hindupur & Penugonda (Andhra Pradesh); Oddanchatrum & Adaikalapattinam (Tamil Nadu). Interview schedule has been developed and pretested and data collection for benchmark survey is under progress.

Cluster Promotion Programme (CPP)

Cluster Promotion Programme is implemented and coordinated by CSRTI-Mysore in Southern Zone (Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, Kerala) and also in Maharashtra and Madhya Pradesh in 106 clusters in collaboration with Departments of Sericulture of respective states. The clusters in Southern zone are categorized into 55 mother clusters and 51 satellite clusters. The clusters are established with an objective to promote bivoltine silk production and also to produce 5000 MT of gradable raw silk by the end of XII plan. Clusters were organized based on farmers profile and potentiality of the area. Each cluster is directly monitored by two Cluster Development Facilitators (CDFs) nominated by Central Silk Board and Department of Sericulture. All the backward and forward linkages are established in these clusters. The cluster development facilitators provide all the technical guidance to the farmers to improve productivity/unit area and also help farmers to increase the mulberry cultivation area within the cluster. During the year, South Zone clusters have

State	Cluster		Bivoltine Raw Silk Production (MT) during 2014-15			
	Mother	Satellite	Target	Achievement	% Achievement	% increase over 2013-14
Karnataka	27	19	852.43	897.27	105.26	65.98
Andhra Pradesh	11	2	413.00	464.64	121.45	38.69
Telangana		4	44.00	45.17	111.83	
Tamil Nadu	11	17	528.00	692.02	124.35	58.31
Kerala	2		2.00	10.26	513.00	211.12
Maharashtra	4	5	9.00	113.16	119.48	110.90
Madhya Pradesh		4	17.14	18.64	108.75	96.75
Total/Avg.	55	51	1943.76	2241.15	115.30	58.75

achieved all time high of 2241.15 MT bivoltine raw silk production with an achievement of 115.3 % against the target and contributes 95% of cluster target and 60% overall target for bivoltine silk production in the country.

An additional quantity of 820.25 MT bivoltine silk production was achieved during the current year and this accounts for 57.73% increase in raw silk production over the previous year. A quantity of 1420.90 MT bivoltine silk was produced against the target of 1400 MT with an achievement of 101.49% during 2013-14. Karnataka produced highest quantity (~900 MT) bivoltine raw silk.

Dfls Distribution: A total of 213.65 lakh dfls were distributed to the farmers in clusters. Tamil Nadu, Maharashtra, Telangana and Andhra Pradesh achieved more than 100% target in dfl uptake. The dfl uptake in the clusters increased by 71.25 lakh dfls over the previous year due to improvement in mulberry acreage, leaf productivity and coordinated extension efforts by CSB & DoS.

Cluster	Annual Target (lakhs)	No. of crops	Dfl Distribution (Nos)	% Achievement	% increase over 2013-14
Karnataka	92.20	52792	8940377	96.97	58.09
Andhra Pradesh	41.20	17742	4548570	110.40	35.74
Telangana	4.35	1664	451100	103.70	
Tamil Nadu	50.25	33383	5954736	118.50	45.03
Kerala	2.00	972	87870	43.93	69.20
Maharashtra	11.05	7987	1158504	104.84	22.30
Madhya Pradesh	2.40	1862	224650	93.60	81.95
Total/Avg.	203.45	116402	21365807	106.06	50.03

Productivity Improvement : The average cocoon productivity was 68.27 kg/100 dfls over 198.42 lakh dfls and 13546 MT bivoltine cocoons were produced in 106 clusters. Highest average cocoon yield (80kg) was achieved in Madathukulam (Tamil Nadu) and Kozhikode (Kerala) clusters. The overall cocoon productivity (kg/100 dfls) recorded reveal that Tamil Nadu stands first (75.54) followed by Andhra Pradesh (66.68), Karnataka (65.23) and Telangana (65.08); cocoon productivity in Kerala

State	Cocoon Productivity (kg/100 dfls)			
	XI Plan	2013-14	2014-15	% Improvement
Karnataka	62.73	65.83	65.23	3.99
Andhra Pradesh	61.56	66.69	66.68	8.31
Telangana			65.08	
Tamil Nadu	71.13	74.46	75.54	6.20
Kerala		76.45	75.88	
Maharashtra	60.73	63.26	63.49	4.54
Madhya Pradesh		52.93	53.93	
Total/Avg.	64.98	68.45	68.27	5.06

was 75.88kg spanning 0.88 lakh dfls. Overall cocoon productivity improved by 5% in clusters. The average cocoon yield/100 dfls in the clusters ranged from 53.93-75.54 kgs/100dfls with a coefficient of variation (CV) of 11.32 %. The performance of Tamil Nadu and Andhra Pradesh clusters was relatively homogenous with lower CV.

Cluster Development Facilitators (CDFs)

Andhra Pradesh		
Clusters	CSB	DOS
Atmakur	Dr. P. Venkataramana, Scientist-D, RECSU-Atmakur	Mr. D Anjaneyulu, SO-Atmakur
Bhimadole	Dr. M. Venkateswara Rao, Scientist-D, REC-Eluru	Mr. N. Satynarayana, SO-Bhimdole
Chebrole	Mr. T.V.S. Srinivasa Rao, Scientist-D, REC-Chebrole	Mr. I. Koteswara Rao, SO-Chebrole
Chittoor	Dr. P. Deepa, Scientist-D, SSPC-Chittoor	Mr. Vasantharayulu, SO-Chittoor
Giddalur	Dr. N.B. Chowdhary, Scientist-D, RECSU-Giddalur	Mr. G. Sudharkar Sharma, ADS (FAC)-Giddalur
Hindupur	Dr. M.P. Reddy, Scientist-D, CPC-Hindupur	Mr. Krishna Reddy, SO-Hindupur
Kalyanadurga	Mr. B. Vijaya Naidu, Scientist-C, REC-Kalyanadurga	Mr. K.Ramakrishna Reddy, ASO-Kalyanadurga
Madakasira	Dr. B. Narasimha Murthy, Scientist-D, REC-Madakasira	Mr. Hanumantharaya, ASO-Madakasira
Palamaner	Dr. G.V. Prasad, Scientist-D, CDC-Palamaner	Mr. S. Noor Basha, ASO-Palamaner
Pattikonda	Dr. P. Venkataramana, Scientist-D, RECSU-Atmakur	Mr. Suresh Kumar, SO-Adoni
Penukonda	Dr. Vidyunmala, Scientist-D, RECSU-Penukonda	Mr. K. Noor Mahammed, ASO-Penukonda
V.Kota	Dr. T. Mogili, Scientist-D, REC-V.Kota	Mr. K. Ramachandar Rao, SO-V.Kota
Vijayawada	Dr. R.N. Prasad, Scientist-C, SSC-Vijayawada	Mr. P. Seenaiah, SO-Vijayawada

Karnataka		
Clusters	CSB	DOS
Andaralahalli	Ms. K. Philomena, Scientist-C, RSRS-Kodathi	Mr. Anil Peer Naik, ADS, DOS-Andaralahalli
Aurad	Mr. Ishwar, Scientist-C, REC-Bidar	Mr. H.C. Nagendrappa, ADS, DOS-Bidar
B.R.Koppalu	Mr. S.B. Nagaraja, Scientist-D, CSRTI-Mysuru	Mr. Mahesh Kumar Vage, ADS, DOS-S.R.Patna
Bannikuppe	Dr. A.R.N. Nayaka, Scientist-D, CSRTI-Mysuru	Mr. T. Afsar Babu, ADS, DOS-Ramanagar
Belgaum	Dr. C.R Hegde, Scientist-C, SSC-Belgaum	Mr. M.C. Uppar, ADS-Belgaum
Bevuru	Dr. B. Gangadhar, Scientist-D, CSRTI-Mysuru	Mr. Aluregowda, ADS, DOS-Channapatna
Bidarakote	Dr. Vinod B Mathur, Scientist-D, REC-Maddur	Mr. M. Mallikarjunaswami, ADS, DOS-Malavalli
Bijapur	Mr. Shreeshail Bheewa Arjune, TA, RECSU-Bijapur	Mr. M.J. Maniyar, ADS, DOS-Bijapur
Challakere	Mr. G.N. Niranjnamurthy, TA, REC-Chitradurga	Ms. K.P. Asha, ADS, DOS-Challekere
Channarayapatna	Dr. M. Maheswari, Scientist-D, RSRS-Kodathi	Mr. M. Suryanarayanagowda, ADS-Channarayapatna
D.Halasaahalli	Dr. S. Purushotham, Scientist-C, CSRTI-Mysuru	Mr. M. Mallikarjunaswami, ADS, DOS-Malavalli
Davangere	Mr. A. Umeha, Scientist-C, REC-Chitradurga	Mr. Pradeep P. Kadadi, ADS, DOS-Davanagere
Doddalahalli	Dr. Dasappa, Scientist-D, CSRTI-Mysuru	Mr. G.M. Mahendra Kumar, ADS, DOS-Kanakapura
Gajanur	Dr. V.K. Harlapur, Scientist-D, SSPC-Malavalli	Mr. M. Mallikarjunaswami, ADS, DOS-Malavalli
Gouribidnur	Mr. Dayananda Reddy, Scientist-D, SSPC-Hindupur	Mr. Anjanamurthy, ADS, DOS-Gauribidanur
Gulbarga	Mr. Ishwar, Scientist-C, REC-Bidar	Mr. Prakash Babu S. ADS, DOS-Gulbarga
H.B. Halli	Dr. Raveendra Mattigatti, Scientist-C, CSRTI-Mysuru	Mr. V. Sudheer, ADS, DOS-Kudligi
H.D.Kote	Dr. B.T.Srinivasa, Scientist-D, CSRTI-Mysuru	Mr. B. Keshavamurthy, ADS, DOS-H.D.Kote
Harohalli	Dr. P. Sudhakara Rao, Scientist-C, RSRS-Kodathi	Mr. P.L. Chandrappa, ADS, DOS-Hosakote
Harohalli	Dr. Y.V. Ramanjaneyulu, Sci-D,SSPC, Ramanagar	Mr. G.M. Mahendra Kumar, ADS, DOS-Kanakapura
Haveri	Mr. K.N. Nandi, STA, SSC-NSSO-Haveri	Mr. Khaji, ADS, DOS-Haveri
Hiriyur	Mr. K.B.Shivanna, TA, REC-Chitradurga	Mr. G. Nagarajappa, ADS, DOS-Chitradurga
Humnabad	Mr. Ishwar, Scientist-C, REC-Bidar	Mr. G.Y.Shinde, ADS, DOS-Humnabad
Ithandahalli	Dr. Noble Morrison, Scientist-D, REC-Madivala	Mr. C.D. Basavaraju, ADS, DOS-Bangarpet
Jamakhandi	Mr. G.M. Ravi Kumar, TA, RECSU-Jamakhandi	Mr. S.B. Muranala, ADS, DOS-Jamakhandi
K..R.Nagar	Dr. D.S. Somaprakash, Scientist-D, CSRTI-Mysuru	Mr. H.B. Boraiah, ADS, DOS-K.R.Nagar
Kanakapura	Dr. H. Jayaram, Scientist-D, RECSU-Kanakapura	Mr. G.M. Mahendra Kumar, ADS, DOS-Kanakapura
Kudligi	Dr. Raveendra Mattigatti, Scientist-C, RSRS-Kodathi	Mr. V. Sudheer, ADS, DOS-Kudligi
Kurudamalai	Dr. Noble Morrison, Scientist-D, REC-Madivala	Mr. M.Venkatesh, ADS, DOS-Mulbagal
Lingasugur	Mr. M. Mritinjaya, TA, RECSU-Koppal	Mr. Rajendra Kumar, SEO, DOS-Lingasugur
Ranebennur	Dr. M.K. Raghunath, Sci.-C, RECSU-Ranebennur	Mr. Khaji, ADS, DOS-Haveri
Raugodlu	Dr. Parthasarathy, Scientist-D, SSPC-Bangalore	Ms. R. Nirmala, ADS, DOS-Raugodlu, Kengeri
Shahapur	Mr. B.M. Krishnappa, TA, RECSU-Shahpur	Mr. S.N. Kayanur, ADS, DOS-Shahapur
Shapur (Kolar)	Dr. Perumalla Sudhakar, Scientist-C, RSRS-Kodathi	Mr. B.L. Krishnappa, ADS, DOS, Kolar
Shirahatti	Mr. Anis Ahamed Shariff, TA, RECSU-Shirahatti	Mr. F.G.Veeranagoudar, ADS, DOS-Shirahatti
Siddlaghatta	Mr. H.S. Phaniraj, Scientist-D, SSPC-Vijayapura	Mr. M.C. Chandrappa, ADS, DOS-Shidlaghatta
Sira	Mr. K. Vedavyasa, Scientist-D, CSRTI-Mysuru	Mr. G.M. Vishwanath, ADS, DOS-Sira
Soraba	Mr. Chinnaswamy, TA, RECSU-Shivamogga	Mr. M.S. Patil, ADS, Shivamogga
T.Narasipura	Dr. K. Srikanta Swamy, Scientist-D, RSRS-Ch.Nagar	Mr. Javaregowda, ADS, DOS-T.Narasipura
Tekal	Mr. H.M. Shanbhogue, Scientist-C, SSPC-Chintamani	Mr. Manjunath , I/C Malur, ADS-DOS Malur
Thoreshettihalli	Mr. J.P. Renukeshawrappa, Scientist-C,CSRTI-Mysuru	Mr. M. Mallikarjunaswami, ADS, DOS-Malavalli
Tubagere	Dr. P.K. Ambika, Scientist-D, RSRS-Kodathi	Ms. D. Ayisha Khanam, ADS, DOS-Doddaballapura
Tumkur	Mr. K. Vedavyasa, Scientist-D, CSRTI-Mysuru	Dr. Y. K. Balakrishnappa, ADS, DOS-Tumkur
Y.N.Hoskote	Mr. N. Shivashankar, Scientist-C, RSRS-Kodathi	Mr. J. Munshi Basaiah, ADS, DOS-Pavagada
Yelburga	Mr. Y.N. Sanath Kumar, Scientist-C, RECSU-Koppal	Mr. B.V.Karurmath, ADS, DOS-Yelburga
Yeldur	Mr. Jeevan Reddy, STA, SSPC-Chintamani	Mr. M. Nagaraja, ADS, Srinivasapura
Kerala		
Clusters	CSB	DOS
Kozhicode	Ms. P.V. Soudaminy, Scientist-C, RECSU-Kalpetta	Mr. Salim Kumar, ASO-Wyanad
Palakkad	Ms.K.Sarala, Scientist-C, REC-Palakkad	

Maharashtra		
Clusters	CSB	DOS
Akola	Mr. R.V. Kushwaha, Scientist-C, REC-Amaravathi	Mr. S.P. Fadke, DSO-Akola
Beed	Mr. Rahul Singh, Scientist-C, RECSU-Aurangabad	Mr. P.M. Chougule, SDO-Beed
Buldhana	Mr. R.V. Kushwaha, Scientist-C, REC-Amaravathi	Mr. H.S. Chavan, DSO-Buldhana
Jalna	Mr. Rahul Singh, Scientist-C, RECSU-Aurangabad	Mr. Ramesh.B. Hande, SDO-Jalna
Nanded	Mr. A.J. Karande Scientist -D, REC-Parbhani	Mr. P.J.Patil, SDO-Nanded
Osmanabad	Mr. A.P. Bagde, Scientist -C, RECSU-Osmanabad	Ms. P.S. Ganacharya/Mr. M.R. Digule-SDO-O.bad
Sangli	Dr. Chandrashekar R. Hegde, Sci-C, SSC, Belgaum	Mr. D.Y. Salunke, SDO-Sangli
Satara	Mr. Ramprakash, Scientist-D, REC Baramathi	Mr. V.S. Pawar, SDO-Satara
Wardha	Mr. R.V. Kushwaha, Scientist-C, REC Amaravathi	Mr. V.M. Paunikar, DSO-Wardha
Madhya Pradesh		
Clusters	CSB	DOS
Betul	Mr. R.K. Khare, Scientist-C, REC-Hoshangabad	Mr. Laxman Lillore, FO-Betul-MP
Burhanpur	Dr. Pradip Shukla, Scientist-C, RECSU-Burhanpur	Mr. Harishankar Sony, FO-Burhanpur
Hoshangabad	Mr. R.K. Khare, Scientist-C, REC-Hoshangabad	Mr. Ravindra Singh, FO-Hoshangabad
Khandwa	Dr. Pradip Shukla, Scientist-C, RECSU-Burhanpur	Mr. Kastur Chandra Choudhary, FO-Khandwa
Tamil Nadu		
Clusters	CSB	DOS
Adaikalapattinam	Mr. B Mohan, Scientist-D, RECSU-Srivilliputhur	Ms. K.S. Selvi, AI(S)-Nanmagaram
Alangkayam	Mr. O.K.Gopinath, Scientist-C, RECSU-Vaniyambadi	Mr. S. Vijayakumar, AI(S)-Vaniyambadi
Alangudi	Mr. N.G. Selvaraj, Scientist-D, RECSU-Trichy	Mr. A. Paneerselvam, AI(S)-TSC, Pudukottai
Annur	Dr. A. Mohamed Babu, Scientist-D, RECSU-Avinashi	Mr. S.Sakthivel, AI(S)-Avinashi
Anthiyur	Mr. Thirunavukkarasu, Scientist-D, REC-Gobi	Mr. M. Thangaraj, AI(S)-TSC, Bhavani
Bagalur	Dr. Jagadishprabhu, Scientist-D, SSPC-Hosur	Mr. A. Murugan, AI(S)-TSC, Bagalur
Berigai	Mr. Y. Humayun Sharief, Scientist-C, RECSU-Berigai	Mr. K. Venkataramanan-AI(S)-Berigai
Bhavani	Mr. Thirunavukkarasu, Scientist-D, REC-Gobi	Mr. M. Thangaraj, AI(S)-TSC, Bhavani
Dharapuram	Dr. P. Samuthiravelu, Scientist-D, REC-Udumalpet	Mr. K.Rajendran, AI(S)-Dharapuram
Dharmapuri	Dr. V.Chinnadurai, Scientist-C, SSPC-Dharmapuri	Mr. S. Lakshmanan, AI(S)-TSC-Dharmapuri
Gobi South	Dr. N. Dhahira Beevi, Scientist-D, REC-Gobi	Mr. S. Gobalakrishnan, AI(S)-TSC,Gobi
Gudimangalam	Mr. R. Anbazhagan, Scientist-C, REC-Udumalpet	Mr. M. Marappan, AI(S)-Gudimangalam
Keeranur	Ms. Punithavathi, Scientist-D, REC-Udumalpet	Mr. M. Natarajan, AI(S)-Dindigul
Kodiyalam	Dr. Jagadishprabhu, Scientist-D, SSPC-Hosur	Mr. A. Murugan, AI(S)-TSC,Hosur
Kottur	Mr. S. Ramesh, TA, SSC-Udumalpet	Mr. A.Alaguramalingam, AI(S)-Pollachi
Kumaralingam	Dr. C.M. Babu, Scientist-D, REC-Udumalpet	Mr. A.V.Murthy, AI(S)-Udumalpet
Madathukulam	Dr. C.M. Babu, Scientist-D, REC-Udumalpet	Mr. A.V.Murthy, AI(S)-Udumalpet
Manurpalayam	Mr. Issac Joseph, Scientist-C, RECSU-Avinashi	Mr. Kanakarathnam, AI(S)-TSC, Avinasi
Oddanchatram	Mr. A.G.K. Daniel, Scientist-D, REC-Samayanallur	Mr. J. Manoharan, AI(S)-TSC, Dindigal
Palani	Ms. G. Punithavathi, Scientist-D, REC-Udumalpet	Mr. M Natarajan, AI(S)-Palani
Pitchandam-palayam	Dr. N. Dhahira Beevi, Scientist-D, REC-Gobi	Mr. S. Gobalakrishnan, AI(S)-TSC, Gobi
Pollachi	Dr. K. Chandrashekar, Scientist-D, REC-Udumalpet	Mr. A.Alaguramalingam, AI(S)-Pollachi
Pongalur	Mr. Issac Joseph, Scientist-C, RECSU-Avinashi	Mr. M. Marappan, AI(S)-Udumalpet
Poolavadi	Dr. P. Samuthiravelu, Scientist-D, REC-Udumalpet	M. Marappan, AI(S)-Poolavadi
Sannarpatti	Mr. T Sivasubramanian,Scientist-C,REC-Samayanallur	Mr. D.Balasubramaniam, AI(S)-Dindigal
Srivilliputhur	Dr. N. Sakthivel, Scientist-D, REC SU-Srivilliputhur	Mr. S. Venkatachalam, AI(S)-Srivilliputtur
Udumalpet	Dr. P. Samuthiravelu, Scientist-D, REC-Udumalpet	Mr. A.V.Murthy, AI(S)-Udumalpet
Uttangarai	Dr. S. Masilamani, Scientist-D, REC-Krishnagiri	Mr. Shanmugha Sundaram, I(S)-Vepanapalli
Telangana		
Clusters	CSB	DOS
Bhongir	Dr. P. Srinivasulu Reddy, Scientist-D, RECSU-Suryapet	Mr. Venugopal, SO- Bhongir
Metapalli	Shri B.V. Sanjeeva Rao, Scientist-C, RECSU-Metpalli	Mr. Venkateswara Rao, ASO-Metapalli
Suryapet	Dr. P. Srinivasulu Reddy, Scientist-D, RECSU-Suryapet	Mr. P. Venkat Reddy, SO-Suryapet
Zaheerabad	Dr. B. Srinath, Scientist-D, REC-Vikarabad	Mr. S. Sudhakar, SO-Zaheerabad

Performance of Clusters - Karnataka (2014-15)											
Cluster	DfIs Distribution			Yield 100 dfIs (Kg)	Performance over 2013-14 %	Raw Silk Production (MT)				New Plantation (acres) ^a	ECP (Farmers) ^b
	Target (Lakhs)	Crops (Nos.)	Ach.			Target	Ach.	% Ach.	Improvement over 2013-14 %		
Gouribidanur	2.50	942	252095	63.03	3.26	23.11	24.45	105.76	176.34		
Andaralahalli	1.20	704	134075	60.87	1.18	11.09	12.56	113.17	156.18	94 (93.20)	303 (9)
Sidlaghatta	2.25	788	183225	64.09	-0.99	20.80	18.07	86.84	198.26	223 (140)	1210 (11)
Raugodlu	0.60	352	62455	70.67	-0.75	5.55	6.79	122.41	196.89		
Y.N. Hosakote	4.00	3007	614600	63.23	-1.55	36.98	59.79	161.67	176.05	458.8 (254)	190 (10)
Tumkur	2.50	2392	330665	69.85	-6.90	23.11	35.54	153.74	95.15	109 (103)	190 (8)
Sira	2.50	2226	329445	73.11	5.50	23.11	37.05	160.31	53.85	119 (105)	120 (5)
Harohalli (B)	3.00	1342	255430	64.55	-1.97	27.74	25.36	91.45	23.68	1309 (1396)	494 (12)
Channarayapatna	0.90	708	98150	63.05	-10.95	8.32	9.52	114.41	147.86	244.6 (235)	317 (13)
Tubagere	0.75	752	107465	71.62	3.48	6.93	11.84	170.77	245.61	176.8 (147)	406 (13)
Shapur Klr	3.00	1288	265740	60.69	2.20	27.74	24.81	89.46	42.64	1277 (477)	702 (10)
lthandahally	4.00	1905	325250	73.16	1.19	36.98	36.61	98.99	2.97	154.2 (97)	134 (24)
Yeldur	0.80	538	101350	73.20	6.09	7.40	11.41	154.30	130.20		
TakeI	2.50	1213	231545	72.36	0.92	23.11	25.78	111.52	38.33	181.8 (128)	
Kurudumalai	2.00	689	186230	64.96	0.39	18.49	18.61	100.65	69.90	213 (173)	300 (12)
Kanakapura	2.50	695	78825	69.32	6.76	23.11	8.41	36.37	16.96	317.5 (251)	393 (13)
Harohalli (KKP)	3.00	1197	129500	66.25	9.65	27.74	13.20	47.58	49.41	133.9 (293)	295 (9)
Challakere	3.50	1930	392535	65.21	-0.15	32.36	39.38	121.70	32.45	305.9 (157)	437 (14)
Hiriyur	2.00	1339	193429	63.21	-5.21	18.49	18.81	101.72	16.02	203 (117)	
Davangere	2.00	1009	160140	64.83	-5.75	18.49	15.97	86.37	66.78	206.3 (114)	143 (4)
Soraba	1.00	727	88243	65.74	0.06	9.25	8.93	96.53	80.81	87.15 (73)	203 (10)
Gajanur	1.50	650	110550	52.74	-11.16	13.87	8.97	64.67	43.68		90 (4)
H.B.hally	2.00	1268	262475	67.99	4.25	18.49	27.45	148.47	96.59	214.25 (125)	724 (8)
Kudligi	2.00	1528	236807	64.90	4.37	18.49	23.64	127.87	156.31	258.25 (158)	130 (4)
Lingasagur	2.00	1195	244995	62.73	-4.30	18.49	23.64	127.86	69.23	307.6 (165)	69 (1)
Ranebennur	3.50	2973	474810	61.07	-7.85	32.36	44.61	137.86	41.89	229.29 (151)	314 (11)
Belagaum	2.50	3285	372300	67.82	-7.45	23.11	38.85	168.06	61.12	426 (328)	1091 (33)
Gulburga	2.50	1584	320535	62.84	-1.11	23.11	30.99	134.06	84.28	734.5 (359)	60 (1)
Aurad	1.00	220	56650	67.76	-5.18	9.25	5.91	63.87	26.44	250 (51)	116 (3)
Humnabad	1.00	344	74000	66.88	-1.49	9.25	7.61	82.35	62.54	181.5 (58)	252 (4)
Yelburga	1.00	842	145950	61.22	-1.01	9.25	13.75	148.68	97.57	184.2 (100)	200 (3)
Shahapur (Y)	0.60	122	25550	54.71	-14.42	5.55	2.15	38.76	18.63	56.1 (31)	167 (7)
Jamakandi	2.00	2521	361850	64.26	-3.76	18.49	35.77	193.45	107.01	558.2 (424)	241 (6)
Bijapur	1.00	699	113525	68.38	-1.65	9.25	11.94	129.16	155.25	476.6 (344)	810 (23)
Haveri	1.50	1270	220310	66.88	5.21	13.87	22.67	163.46	81.87	179.35 (147)	30 (2)
Shirahatti	1.50	1177	196050	65.23	-3.56	13.87	19.67	141.86	62.27	271.7 (139)	1269 (13)
D. Halasahally	1.00	602	81000	62.93	3.74	9.25	7.84	84.82	64.94	470.37 (72)	165 (6)
H.D. Kote	2.00	1064	135865	66.19	-0.81	18.49	13.84	74.82	54.10	114.67 (103)	396 (11)
Thoresettyhally	2.00	299	40628	49.50	9.56	18.49	3.09	16.73	51.58	315 (272)	341 (11)
T. Narasipura	2.00	849	170100	62.18	6.49	18.49	16.27	88.00	80.62	199.22 (183)	466 (13)
Bidarakote	2.00	343	53900	63.53	1.59	18.49	5.27	28.49	138.03	163.19 (179)	272 (12)
B.R.Koppalu	4.00	1610	403490	60.84	4.47	36.98	37.77	102.12	60.88	273.37 (241)	539 (10)
Bevuru	2.00	838	86375	65.24	7.07	18.49	8.67	46.88	83.73	302.5 (313)	572 (12)
Bannikuppe	2.50	553	101075	63.46	2.03	23.11	9.87	42.69	18.62	179.24 (150)	384 (13)
K.R. Nagar	0.60	415	45455	61.08	-11.07	5.55	4.27	77.00	33.10	91 (98)	262 (11)
Doddalahalli	2.00	798	85740	71.01	0.27	18.49	9.37	50.66	84.53	316.91 (442)	612 (13)
Total/Avg.	92.20	52792	8940377	65.23	-0.79	852.46	897.27	105.26	65.55	12566 (8987)	15409 (410)

Performance of Clusters - Tamil Nadu (2014-15)											
Cluster	DfIs Distribution			Yield 100 dfIs (Kg)	Performance over 2013-14 %	Raw Silk Production (MT)				New Plantation (acres) ^a	ECP (Farmers) ^b
	Target (Lakhs)	Crops (Nos.)	Ach.			Target	Ach.	% Ach.	Improvement over 2013-14 %		
Udumalpet	3.50	2223	391475	79.59	-0.16	38.76	47.93	123.66	47.75	42 (22)	239 (7)
Komaralingam	1.00	419	92100	78.73	1.30	11.08	11.16	100.73	45.26	12 (6)	34 (2)
Madathukulam	2.00	1099	205475	80.30	1.91	22.15	25.38	114.60	54.76	18 (9)	124 (28)
Alangudi	0.60	654	103525	71.74	5.00	6.65	11.43	171.95	135.57	76.5 (46)	891 (28)
Gudimangalam	2.00	990	211925	75.54	0.11	22.15	24.63	111.20	74.01	19 (11)	289 (7)
Poolavadi	2.00	1384	290475	76.12	-0.62	22.15	34.02	153.58	75.50	49 (26)	173 (2)
Bhavani	1.25	1220	200565	77.32	2.56	13.84	23.86	172.34	92.62	84.5 (35)	221 (7)
Anthiyur	1.25	1281	206035	75.47	5.88	13.84	23.92	172.80	98.29	70 (38)	120 (5)
Pollachi	2.00	1339	228675	77.81	2.25	22.15	27.38	123.59	41.04	34.75 (18)	390 (10)
Kottur	0.75	443	83550	77.45	0.80	8.31	9.96	119.86	39.93	6 (3)	
Adaikalapattinam	1.40	918	140350	71.66	4.70	15.51	15.47	99.80	15.56	19 (18)	591 (37)
Bagalur	0.75	352	75550	79.93	6.83	8.31	9.29	111.84	70.91	24.25 (14)	98 (5)
Kodiyalam	1.20	395	108000	79.84	8.30	13.29	13.27	99.82	44.72	36.15 (20)	81 (5)
Gobi South	1.75	1199	208550	72.74	2.30	19.38	23.34	120.42	34.95	98 (34)	312 (12)
Pitchandampalayam	2.00	1303	255975	72.93	-1.24	22.15	28.72	129.66	40.28	95 (34)	185 (12)
Dharapuram	2.25	1484	232240	75.22	10.00	24.92	26.87	107.85	161.19	132.7 (81)	60 (3)
Manurpalayam	1.50	840	150975	76.78	2.41	16.61	17.83	107.35	63.76	60 (42)	58 (6)
Palani	3.25	1380	343975	76.00	1.12	35.99	40.22	111.73	26.02	38.5 (16)	272 (4)
Keeranur	2.75	1098	263375	75.72	1.14	30.46	30.68	100.74	16.19	36 (15)	154 (7)
Uthangerai	2.00	2011	285847	74.46	0.30	22.15	32.75	147.84	73.10	309 (203)	337 (14)
Alangkayam	1.50	1619	276950	74.30	8.57	16.61	31.66	190.56	146.57	48 (55)	432 (15)
Srivilliputhur	2.00	1322	240650	74.14	7.36	22.15	27.45	123.92	46.54	50 (23)	352 (16)
Ottanchatram	2.50	1292	278699	76.58	3.58	27.69	32.83	118.59	92.64	29 (13)	365 (25)
Sannarpatti	2.00	1207	225200	75.91	2.62	22.15	26.30	118.73	102.60	50.5 (29)	283 (24)
Annur	2.75	2542	315000	73.08	-5.45	30.46	35.42	116.29	28.99	281 (155)	549 (30)
Pongalur	0.60	718	119165	75.42	-2.81	6.65	13.83	208.08	191.51	114 (63)	25 (11)
Dharmapuri	1.20	1348	139785	68.15	-10.90	13.29	14.66	110.28	23.89	107.75 (73)	574 (22)
Berigai	2.50	1303	280650	74.67	2.48	27.69	32.24	116.44	32.63	274 (158)	405 (19)
Total/Avg	50.25	33383	5954736	75.54	1.38	556.52	692.02	124.35	57.28	2214.6 (1260)	7614 (340)
Performance of Clusters - Kerala (2014-15)											
Palakkad	1.00	870	80595	75.50	-1.96	11.08	9.36	84.49	221.4	42.5 (44)	714 (34)
Kozhikode	1.00	102	7275	81.40	10.06	11.07	0.91	8.23	135.0	14 (13)	266 (16)
Total/Avg	2.00	972	87870	75.88	-1.06	22.15	10.26	46.31	210.9	56.5 (57)	980 (50)
Performance of Clusters - Andhra Pradesh (2014-15)											
Giddalur	2.00	512	212400	68.04	3.29	18.57	22.23	119.72	29.63	(131.50)48 ^a	(739)14 ^b
Madakasira	4.00	1933	483125	67.89	3.19	37.14	50.46	135.86	47.00	(161.0)140	(277)6
Pattikonda	2.10	434	206100	66.23	1.15	19.50	21.00	107.69	65.59	(72.0)40	(162)6
Atmakur	1.00	424	126300	64.20	4.75	9.29	12.47	134.34	93.10	(93.5)38	(156)5
Bhimadole	2.00	632	163350	66.85	3.36	18.57	16.80	90.46	17.71	(440.0)182	(0)0
Kalyanadurgam	1.50	1019	246945	67.31	-0.61	13.93	25.57	183.61	93.02	(193.0)174	(331)8
V. Kota	12.00	4357	1155000	68.05	-2.02	111.43	120.92	108.51	6.64	(57.6)65	(529)12
Palamaner	5.50	4514	961550	66.86	2.01	51.07	98.90	193.66	100.58	(150.0)178	(196)5
Hindupur	3.50	1140	265950	64.43	1.38	32.50	26.36	81.11	31.41	(45.0)45	(155)6
Penukonda	1.60	557	147350	63.54	-1.76	14.86	14.40	96.94	29.60	(38.0)40	(230)8
Chebrolu	2.50	870	251000	63.19	0.62	23.21	24.40	105.11	24.07	(120.0)39	(472)8
Vijayawada	2.00	872	219500	64.79	-7.96	18.57	21.88	117.82	22.63		
Chittoor	1.50	478	110000	66.40	-0.71	13.93	11.24	80.68	39.05	(10.0)10	
Total/Avg	41.20	17742	4548570	66.68	-0.02	382.57	466.60	121.97	38.21	(1511.6)999	(3247)78

Performance of Clusters - Maharashtra (2014-15)											
Cluster	Dfls Distribution			Yield 100 dfls (Kg)	Performance over 2013-14 %	Raw Silk Production (MT)				New Plantation (acres) ^a	ECP (Farmers) ^b
	Target (Lakhs)	Crops (Nos.)	Ach.			Target	Ach.	% Ach.	Improvement over 2013-14 %		
Nanded	1.20	762	142700	60.27	-3.34	10.29	13.23	128.65	88.45	160 (123)	529 (21)
Osmanabad	1.25	669	110100	68.16	-8.94	10.71	11.55	107.76	180.64	255 (192)	802 (21)
Sangli	1.00	571	80950	65.12	4.02	8.57	8.11	94.62	52.70	122 (99)	696 (34)
Satara	1.80	836	118238	67.92	9.01	15.43	12.35	80.08	49.34	128.5 (124)	313 (8)
Jalna	1.80	2775	251050	63.53	0.24	15.43	24.54	159.06	165.81	544 (476)	470 (18)
Beed	1.75	1245	267800	63.18	0.94	15.00	26.03	173.54	89.79	322 (301)	1062 (21)
Akola	0.75	261	40650	61.45	-3.65	6.43	3.84	59.78	64.20	47.5 (34)	320 (11)
Wardha	0.75	442	87000	59.83	-0.88	6.43	8.01	124.57	66.24	165.5 (83)	176 (5)
Buldana	0.75	426	60016	60.22	-2.40	6.43	5.56	86.49	100.30	168 (139)	359 (13)
Total/Avg	11.05	7987	1158504	63.49	0.36	94.71	113.16	119.48	96.45	1912.5 (1571)	4727 (152)
Performance of Clusters - Madhya Pradesh (2014-15)											
Betul	0.90	730	91250	56.88	2.61	6.53	7.98	122.37	77.12	100 (100)	
Burhanpur	0.50	446	47000	46.25	-5.82	3.63	3.34	92.24	62.52	762 (762)	881 (13)
Khandwa	0.50	313	32900	49.26	-2.13	3.63	2.49	68.78	156.62	300 (300)	1068 (11)
Total/Avg	2.40	1862	224650	53.93	1.90	17.40	18.64	107.13	96.21	1212 (1212)	3425 (46)
Performance of Clusters - Telangana (2014-15)											
Suryapet	1.30	528	157750	69.33	5.37	12.07	16.8262	139.39	189.45	317.5 (137)	581 (17)
Bhongir	1.00	318	78850	63.49	-0.63	9.29	7.7019	82.94	87.14	38.5 (16)	280 (35)
Zaheerabad	1.30	413	137700	66.92	-2.34	12.07	14.1761	117.44	38.22	65 (45)	192 (7)
Metpalli	0.75	405	76800	61.30	1.48	6.96	7.2429	104.00	109.59	279 (221)	276 (15)
Total/Avg	4.35	1664	451100	65.08	-0.97	40.39	45.1665	111.82	91.05	700 (419)	1077 (74)

^a Figures in parenthesis indicate number of farmers under taken new plantation

^b Figures in parenthesis indicate number of events conducted

Cluster Performance - Karnataka: Karnataka stands first with more than one-third of the bivoltine raw silk production (852.43 MT with 105.23% achievement; 66% improvement over the previous year) in the clusters in south zone. Twenty-two clusters achieved >100% in distribution of dfls with 58% improvement in dfl uptake as compared to previous year. The overall cocoon productivity improved by 4% in the clusters.

Cluster Performance - Andhra Pradesh: Bivoltine raw silk production in the state improved by 38.69% and the improvement in cocoon productivity was highest (8.3%) as compared to previous year. Seven clusters (Palamaner, Kalyanadurgam, Atmakur, Madakasira, Vijayawada, Giddalur and Chebrolu) achieved >100% target in dfl uptake and the average cocoon yield ranged from 63.19 to 68.05 kg/100 DFLs with overall average being 66.68kg in the clusters.

Cluster Performance - Telangana: Four satellite clusters in the state have improved in average cocoon yield and dfl uptake. The overall improvement in cluster performance is coupled with the un-divided state of Andhra Pradesh. Suryapet, Zaheerabad and Metpalli clusters achieved >100% target in dfls with an average cocoon yield of 65.08 kg/100 dfls.

Cluster Performance - Tamil Nadu: The state stands first in cocoon productivity per unit in the country with 75.54kg/100 dfls with an improvement of 6.2% over the previous year covering 59.54 lakh dfls. The estimated raw silk production was 692.02MT against the target of 556.52MT, with an increase of 58% over the previous year. The overall dfl uptake in the clusters improved by 45% and twenty five clusters recorded >100% achievement in dfls distribution. The average cocoon yield ranged from 68.15kg (Dharmapuri) to 80.30 kg/100 dfls (Madathukulam).

Cluster Performance - Kerala: The overall improvement in bivoltine raw silk production was around 70% with highest cocoon productivity covering 0.88 lakh dfls and lesser farmers with an achievement of 44% against the targets in terms of dfl distribution.

Cluster Performance – Maharashtra: Beed, Nanded, Jalna and Wardha clusters achieved >100% targets in dfls distribution with 22% increase in overall dfl uptake in the state. The overall improvement in bivoltine raw silk production was 110% with 4.5% improvement in cocoon productivity.

Cluster Performance - Madhya Pradesh: Betul and Hoshangabad clusters achieved >100% targets in dfl distribution and the overall improvement in bivoltine raw silk production was 82% with marginal improvement in cocoon productivity.

New Plantation: More emphasis was given for the horizontal expansion in clusters to increase the silk production by motivating farmers and resulting in an additional plantation of 20173.7 acres (14505 farmers in 106 clusters) with improved mulberry varieties.

Extension communication Programmes (ECP):

Different ECPs (1150) including group discussion, awareness, enlightenment, exposure visits, exhibitions and capacity building programmes were conducted in the clusters and sensitized 36479 farmers on new/improved technologies. These have helped in increased the technology adoption resulting in productivity improvement.

Clusters - Evaluation & Monitoring: The performance of clusters in the South Zone and the states of

Maharashtra and Madhya Pradesh were effectively monitored by Director, CSRTI-Mysore as South Zone coordinator and five nodal officers. The progress of bivoltine silk production in the clusters was reviewed every month by the nodal officers and zonal coordinator, while the quarterly progress is analyzed state- and zone-wise by the Member Secretary-CSB. The review meeting also focuses on issues in the clusters and appropriate solutions for improvement.

Institute-Village Linkage programme (Seri Model Village)

Objective: Transfer of Technology through Institute-Village Linkage programme (IVLP) for sustainable/stable bivoltine cocoon production.

IVLP was re-initiated in eleven centres through CSRTI-Mysore and its nested units (RSRSs/RECs/REC-SUs) in Karnataka (4), Andhra Pradesh (2), Tamil Nadu (2), Maharashtra (2) and Madhya Pradesh (1) with 1089 farmers identified covering around 1000 acres of mulberry plantation.

State	Centres	Scientist
Karnataka	Kadakola	S. B. Nagaraja, Sci-D, CSRTI-Mysuru
	K.M. Doddi	V. Gunashekar, Sci-D, CSRTI-Mysuru
	Hosakote	V. Lakshmanan, Sci-D, REC-Bidarguppe
	Chamarajanagara	K. Srikantaswamy, Sci-D, RSRS-Chamrajanagar
Tamil Nadu	Sathyamangalam	Thirunavukkarasu, Sci-D, REC-Gobichettypalayam
	Thondamathur	K. Sarala, Sci-C, REC-Palakkad
Andhra Pradesh	Rayachoty	M. Venkatachalapathi, Sci-D, REC-Rayachoty
	Vizanagaram	T.V.S. Rao, Sci-D, REC-Chebrolu
Maharashtra	Ahmadnagar	Ramprakash, Sci-D, REC-Baramathi
	Baramathi	
Madhya Pradesh	Hoshangabad	R.K. Khare, Sci-D, REC-Hoshangabad

Based on benchmark survey of identified farmers was conducted before implementation to determine the existing status of technology adoption and to identify technology needs, the following mulberry cultivation and silkworm rearing technologies were identified for implementation. To ensure 100% technology adoption, critical inputs were provided to the farmers free of cost through respective RSRSs/RECs. Further, awareness programmes on various technologies

Cluster Promotion Programme (CPP) Activities (2014-15)



Well-Pruned garden at Udumalpet



Well-Grown Plantation at Shirahatti



Grown-up Saplings in Jalna Cluster



Exposure Visit of B R Koppalu Farmers



Harvesting Care at V.Kota Cluster



Group Discussion at Betul Cluster



Bivoltine Cocoon Market at Palamaner



Enlightenment Programme at Aurangabad

Activities @ Sericulture Farmer's Workshops (2014-15)



Release of G2 Mulberry Variety at Bidar



Scientist-Farmers Interaction at Bidar



Resham Krishi Mela at Virudunagar



Krishi Mela Inauguration by CSB Chairman at Warangal



Krishi Mela at Madakasira



Sericulture Exhibition at Hoshangabad



Farmers workshop at Chithradurga



Demonstration of Technologies at Jalna

Technologies Implemented under IVLP	
Mulberry Cultivation	Silkworm Rearing
• Soil tests for maintaining soil health	• Disinfection and hygiene maintenance
• Soil fertility management	• Supply of chawki reared worms
• Popularization of new mulberry varieties	• Use of silkworm bed disinfectants for management of silkworm diseases
• Management of mulberry pests	• Mounting and spinning care for production of quality cocoons
• Application of Poshan—for leaf quality & to correct nutrient deficiencies	• IPM of Uzi fly

was created through demonstrations and ECPs. A total 3.59 lakh dfls of bivoltine hybrids were reared with farmers and an average yield of 62.3 kg/100 dfls was recorded with 8.5% improvement in cocoon yield against the benchmarks. Though the programme was initiated in Sept 2014 and generally crossbreed rearing farmers were encouraged to rear bivoltine hybrids, a quantity of 34.45MT of bivoltine raw silk was produced through IVLP.

Achievements of IVLP (2014-15)						
State	Dfls Brushings (Nos)		Cocoon Yield/100 dfls (kg)			Raw Silk Production (MT)
	Target	Achievement	Benchmark	Avg. Yield	% Improvement	
Karnataka	150000	154570	57.67	61.11	5.96	14.53
Tamil Nadu	114000	99162	63.00	72.25	14.68	11.02
Andhra Pradesh	67500	26650	52.50	56.88	8.34	2.33
Maharashtra	80000	63125	60.00	65.30	8.83	6.34
Madhya Pradesh	34500	15880	50.00	51.34	2.68	1.25
Total/Avg.	446000	359387	57.40	62.30	8.50	34.45

Performance of IVLP Centres							
IVLP Centre	Dfls Brushings (Nos)		Cocoon Yield/100 dfls (kg)			Raw Silk Production (MT)	
	Target	Achievement	Benchmark	Average Yield	% Improvement	Annual Target	Achievement
Kadakola	50000	69220	60.00	62.50	4.26	4.62	6.65
K.M. Doddi	50000	52150	58.00	60.00	3.45	4.62	4.81
Hosakote	50000	33200	55.00	60.83	10.00	4.62	3.10
Sathyamangalam	57000	56267	59.00	70.80	20.00	5.26	6.20
Thondamuthur	57000	42895	67.00	73.70	7.84	5.26	4.82
Rayachoty	25000	17800	55.00	62.50	13.64	2.31	1.70
Vizanagaram	42500	8850	50.00	51.26	2.52	3.92	0.60
Ahmadnagar	30000	33000	60.00	62.70	4.50	2.77	3.18
Baramati	50000	30125	60.00	67.90	13.17	4.62	3.15
Hoshangabad	34500	15880	50.00	51.34	2.68	3.18	1.25
Total	446000	359387	57.40	62.30	8.50	41.17	34.45

Sericulture women and technology transfer – A Group Approach (Apr. 2013 to Oct. 2014)

G. S. Geetha, P. Sudhakara Rao¹, K. L. Rajanna¹ (1RSRS, Kodathi)

Objectives

- Skill development for women on improved silkworm rearing and mulberry cultivation technologies
- Promote sericulture based self employment for rural sericulture women for income augmentation
- Create awareness on available resources/inputs through government departments/institutions for effective utilization and increased output
- Improve cocoon yields and income of sericulture farmers

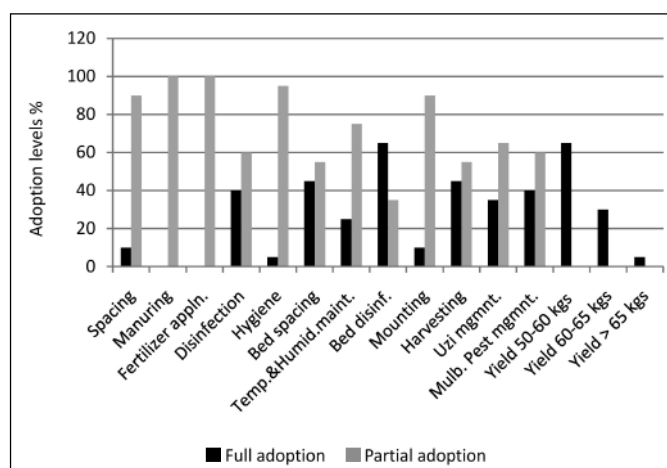
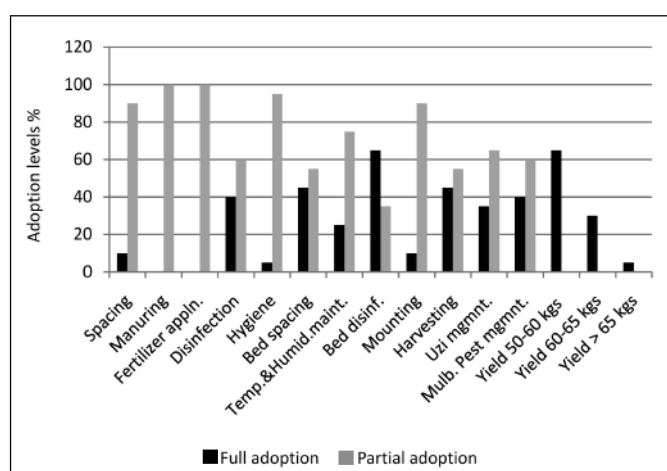
Socio Economic & Personal Profiles		
Variable	Class/Category	%
Age	< 25	24
	25-35	42
	35-45	18
	45-55	6
	>above	10
Marital Status	Married	93
	Single	07
Education	Illiterate	36
	Primary school	13
	Middle school	10
	High school	27
	PUC	11
	> Graduation	3
Family Size	< 3 members	26
	3 - 5 members	67
	>5 members	7
Caste	Vokkaliga	72
	BC	27
	SC/ ST	1
Sericulture Experience	< 10 yrs	58
	10-20 yrs	34
	20-30 yrs	7
	> 30 yrs	1
Silkworm Hybrid	Crossbreed	100
Total Land Holding (acres)	Less than 5	95
	5-10	05
Land under Mulberry	< 2	85
	2-4	15
Avg. Yield/100 dfls	50-60 kg	65
	60-65 kg	30

Sericulture is more accepted and practically taken up by small families with a family size of 3-5 members disproving conception that sericulture is more suitable for joint families as it provides employment with lesser land holding for regular income. Majority of the sericulture practicing women are new to sericulture industry with <10 years experience. Feedback analysis indicate that technologies viz., disinfection, maintenance of hygiene, bed spacing, maintenance of temperature and humidity, bed disinfection, mounting and harvesting) with higher (80-95%) adoption levels.

Continuous/Other Activities

Transfer of Technology Programmes: CSRTI-Mysore and its nested units (RSRSs/RECs/REC-SUs) in Karnataka, Andhra Pradesh, Tamil Nadu, Maharashtra and Madhya Pradesh conducted several transfer of technology (ToT) programmes in sericultural activities, which resulted in benefiting the stakeholders with significant impact in crop productivity.

The study was taken up Ittasandra village located in Nandagudi Hobli of Hosakote taluk, Bangalore rural district. A survey was conducted to understand the village and participation profile of sericulturists and twenty women practicing sericulture were selected. Group discussions were held with the sericulturists to appraise the benefits of group and benchmark survey was conducted to understand the socio economic status, knowledge and adoption levels of sericulture technologies. Based on benchmark survey, unknown and non-adopted technologies were identified to disseminate through suitable extension methods (ECPs). Feedback analysis was made to understand effectiveness of technology transfer through groups by analyzing data using descriptive statistic method.



TOT Activity	RSRS ATP		RSRS Kodathi		RSRS Salem		RSRS Ch Nagar		Impact
	T	Ach	T	Ach	T	Ach	T	Ach	
New mulberry varieties RC1/ RC2/G2/ AR12 (Acreage)	5	5			2.5	2.5	2	2	Improvement in leaf yield by 15.48 (RC1) & 5.74 (RC2)
Tree plantation (No. of farmers)							5	5	Survival percentage: 90-100%
INM (No. of farmers)	36	36	15	15	178	178	5	5	Improvement in leaf yield (7 -17%) & cocoon yield (26.33- 30%)
IPM - Mulberry (No. of farmers)	50	50	37	37	144	144			Reduction in disease incidence (3-30 to 1-4%), resulting increase (8-15%) in leaf yield
IPM – Silkworm (No. of farmers)					171	171			Reduction in crop loss: 7.45 to 1.62%
Navinya (No. of farmers)	15	15	156	156	122	122			65-70% survivability in root rot affected gardens
Nemahari (No. of Farmers)			10	10					Increase in leaf yield by 21- 25%
Composting (No. of farmers)	10	10	10	10	86	86			Reduction of 40-45 days in composting
Poshan (No. of farmers)	20	20	10	10	226	226			Improvement in leaf yield upto 16%
Organic Farming (No. of farmers)							4	4	Improvement in leaf yield (13.34%) & cocoon yield (25.14%)
Popularization of new bivoltine hybrids(No. of dfls)		19250		47050		38950			Avg. Yield/100 dfls (kg) G11 x G19 67.00 L14x CSR2 55.31 S8 x CSR16 77.56 CSR16 x CSR17 63.51 MASN4 X CSR4 68.64 FC3 x FC4 67.67 CSR50 x CSR51 69.14

Extension Communication programmes: Extension Communication Programmes (660) were conducted in Karnataka, Tamil Nadu, Andhra Pradesh, Telangana, Maharashtra, Madhya Pradesh and Kerala. Farmers were sensitised in new bivoltine sericulture technologies through ECPs. The major topics covered were: popularisation of new mulberry varieties; soil testing & its importance in mulberry cultivation; popularisation of tree mulberry; INM practices for mulberry; IPM; integrated disease management practices; disinfection & hygiene in silkworm rearing; popularization of new silkworm hybrids; demonstration of rotary mountages; mounting & spinning care etc.

ECP	Events (Nos)	Farmers Sensitized (Nos)
Exhibition	43	10007
Enlightenment Programme	35	6409
Group Discussion	247	6292
Field Day	90	4448
Awareness Programme	113	5050
Film Show	32	1829
Technology Demonstration	60	1169
Study Tour	35	1431
Workshop/Krishi Mela	05	2558
Total	660	39193

Model commercial CRC

G. S. Vindya, S. B. Nagaraja and C. Parameshwara

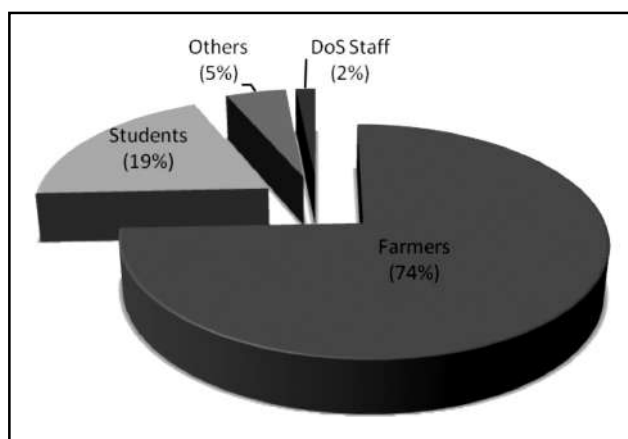
Thirty two batches of chawki rearing batches were reared with 83900dfls of bivoltine hybrids (single & double) for demonstration and to generate revenue. The chawki worms were distributed to 194 farmers covering 83 villages under CPP and IVLP clusters. Simultaneously training was imparted in chawki rearing technology to 322 trainees under

structured/ need-based/seed act/ ISDS-MOT programmes. Special training programme for 100 persons was carried out under NBT based on the requirement of DoS, Karnataka and the programme was for 3crops in 30 days.

Month	Dfls brushed	Distribution to farmers (No.)	Yield/ 100 dfls (kg)	Yield Improvement (%)	Trainees (No.)	State
April	4000	14	68.5	5.3	5	KA
May	6600	15	67.4	3.6	14	KA
June	6600	12	68.0	4.6	20	KA & MAH
July	4400	10	69.0	6.1	16	KA & TN
Aug.	4700	14	67.6	4.0	54	KA & MAH
Sept.	7600	12	68.0	4.6	44	TN
Oct.	10500	17	69.4	6.7	17	KA & AP
Nov.	8000	22	69.5	6.8	30	KA
Dec.	12000	25	68.4	5.2	36	KA & MAH
Jan.	7000	16	73.5	13.0	22	KA & Kerala
Feb.	7000	18	81.5	25.3	26	KA & MAH
March	5500	19	79.0	16.9	38	KA & MAH
Total/ Avg.	83900	194	70.8	8.9	322	

Feedback Analysis on CRC Training Programmes (ISDS, Seed Act, TUP, NBT & Refresher Course)			
Trainees	Before	After	% Improvement
Income from CRC/Crop (Rs.)	30000 - 50000	45000 - 75000	28 – 50
Cocoon Yield/100 dfls (kg)	50 – 60	70 – 85	20 – 49

VISITORS' SERVICE: CSRTI- Mysuru is a visiting place especially for the students of biological sciences, farmers from sericulture background and foreign visitors. The visit of 5471 farmers, 1417 students and 358 others including twenty nine foreigners was co-coordinated covering different laboratories and interactions with scientists.



State	Farmers	Students	Others	DOS Staff	Total
Andhra Pradesh	50		3	17	70
Delhi	34		1		35
Karnataka	4966	989	277	64	6296
Kerala		205	16		221
Maharashtra	81	28	9	16	134
Meghalaya	50		4		54
Punjab			8		8
Sikkim	22		2		24
Tamil Nadu	221	135	27	18	401
Uttar Pradesh		60	6		66
West Bengal	47		5		52
Total	5471	1417	358	115	7361

Sericulture Farmer's Workshops

Bidar-Karnataka: CSRTI-Mysuru organized Sericultural Farmers Workshop (28th Jan. 2015) at Bidar in coordination with DoS-Karnataka. Around 1500 farmers from northern districts of Karnataka; neighbouring districts of Telangana, Andhra Pradesh and Maharashtra; CSRTI-Mysuru & its nested units scientists & officials; DoS Staff attended. The workshop was aimed to create awareness and empower farmers with new sericulture technologies developed for bivoltine sericulture and an exhibition of new technologies/ products/ machines/ equipments were displayed. Progressive

farmers (91) were felicitated by DoS-Karnataka for best performances. An interactive technical session was conducted for the benefit of participating farmers for immediate clarifications on technical issues raised by the farmers. The workshop also witnessed the release of technical literature, mulberry & silkworm hybrid and equipments for the benefit of sericulturists.

Chitradurga-Karnataka: REC- Chitradurga in coordination with DoS organized district level Workshop-cum-Enlightenment Programme at Hosadurga (7th Feb. 2015) in which 378 sericulturists participated. During the technical session, scientists explained about soil testing, soil reclamation, package of practices for production of quality mulberry leaves, disinfection, silkworm diseases & their management, new silkworm hybrids, bivoltine silkworm rearing management and importance of CRC. Three best sericulturists from all the taluks were felicitated during the occasion. An exhibition was also organized for the benefit of visiting farmers.

Salem-Tamil Nadu: Sericulture Technology Workshop was organized by DoS in coordination with RSRS-Salem (14th June 2014) at Salem and 291 sericulturists including

women and 144 DOS officers / CSB scientists participated. The workshop witnessed the launching of an Integrated Voice Response System (IVRS) for the benefit of silk farmers, traders and weavers for the current market price of cocoons and silk yarn. Sericulture exhibition and technical session were arranged for the benefit of the farmers.

Virudunagar- Tamil Nadu: A Resham Krishi Mela was organized jointly by RSRS-Salem and DoS-Tamil Nadu (5th July 2014) at Virudunagar and around 750 farmers attended the mela A book on "Organic Farming in Mulberry" and technological bulletins (Disinfection & hygiene in silkworm rearing; Silkworm diseases & their management; Silkworm body & rearing bed disinfectants; Silkworm rearing houses; Mechanization in Mulberry Cultivation; Guidelines for quality cocoon harvest & Mounting & Spinning Care in Tamil were released. Sericulture exhibition and technical session were also organized for the benefit of visiting farmers.

Warangal-Telangana: RSRS-Anantapur and DoS-Telangana organized Sericulture Farmers' Workshop at Warangal (29th March 2015) and around 600 famers participated. Technology handouts (G2- Chawki Purugula Pempakaniki Pratyekamuga Abhiruddi Parichina Noothana Mulberry Vangadam; Chawki Purugula Nanyatha Dhruveekarana Paddathi; Adikadigubadinichu Noothana Pattu Purugula Rakamulu & Plastic Nethrikalanundi Pattugullanu Vidipinchu Yanthram" were released for the benefit of farming community on this occasion. Technology session was also organized to discuss farmers' issues and clear their doubts.

Madakasira- Andhra Pradesh: RSRS-Anantapur and DOS-AP organized Sericulture Farmers' Workshop at Madakasira (5th March 2015) and around 700 farmers, 90 DOS & CSB officials/scientists/staff participated. On this occasion, a booklet on "Pattu Vyavasayam Saanketaka Parignanam" was released for the benefit of farming community. CSB Scientists and DOS Officers cleared the technical issues doubts regarding several aspects raised by the farmers in technical session.

Technology Releases during Farmers' Workshop

- 'Reshme Krishi Tantrikate Kaipidi' - Technical book with detailed information on new sericulture technologies
- 'Male Neeru Koilu' – Booklet on *in-situ* rainwater harvesting and conservation methods
- Tray washing cum Disinfection Machine – Equipment to reduce the drudgery and health hazards washing of chawki rearing trays and disinfection of rearing room
- G11 x G19 - New Productive Bivoltine Silkworm Hybrid suitable for sub-optimal conditions for sustainability
- G2 - New mulberry variety suitable for chawki silkworm rearing with higher productivity and quality leaf
- Leaflets (Kannada and English) on Biological Control of Insect Pests in Sericulture; Chawki Certification; Cocoon Harvester for Plastic Collapsible Mountages; New Productive Bivoltine Silkworm Hybrids; G2 Mulberry Variety for Chawki Silkworm Rearing; Mountages & Mounting Care; Tray Washing cum Disinfection Machine

26. Report on SEEM division attached extension units:

Supply of seed cuttings/saplings of improved mulberry varieties and performance of CSR hybrids

Name of centre	Mulberry area (ac)	No of rearers	No of dfls reared	Average cocoon yield (kg/100 dfls)
REC Amaravathi	404	1135	187666	60.22
REC SU Osmanabad	192	669	90400	68.16
REC SU Burhanpur	250	150	72900	47.00
REC SU Maddur	61	774	155625	59.06
REC Parbhani	96	160	29750	68.00
REC Baramathi	85	525	113150	66.50
REC SU Shivamogga	106	474	66400	67.00
REC SU Jalna	544	690	253050	64.19
REC Hoshangabad	150	127	7750	60.65
REC Aurangabad	300	334	48075	64.80

Extension Communication programmes conducted by CSRTI nested units

Name of centre	GD	FS	EX	FD	AP	EP	DE	ST
REC Amaravathi	12		02	04	10		06	
REC SU Osmanabad	08			02	02		07	
REC SU Burhanpur	06			04		02	06	
REC SU Maddur	05			01			05	
REC Parbhani	05			02	04		05	02
REC SU Shivamogga	06			01			02	
REC Baramathi	06	06		03	03	04		03
REC SU Jalna	04			01	03		07	01
REC Hoshangabad	08			06		01		
REC Aurangabad	05			01	03	01	06	

CAPACITY BUILDING AND TRAINING

S. D. Sharma, V. N. Sudha (up to 30-06-2014), R. S. Katiyar, A. S. Suma (from 27-10-2014), C. Parameswara (from 22-10-2014) and S. N. Pallavi (up to 09-06-2014)

Several DoS officials and farmers were trained under different programmes (MDP: Management Development Programme; TUP: Technology Upgradation Programme; ISDS: Integrated Skill Development Scheme; NBT: Need-Based Training; CC: Certificate Course; ITP: International Training Programme) under enterprise promotion and training under XII plan (CSS 2109) including international trainings sponsored by ITEC, Ministry of External Affairs:Govt. of India. Four-fifths of training programmes were conducted at various RSRS and REC units of CSRTI-Mysuru for the benefit of DoS-officials and farmers.

Prog.	Course	Duration
MDP	Mechanization in Sericulture	4 days
	Extension Management	5 days
	Refresher Course	5 days
	Integrated Pest Management	5 days
	Late Age Rearing	10 days
TUP	Chawki rearing	8 days
	Late age silkworm rearing	10 days
	Mulberry Cultivation	5 days
	Integrated pest & disease management	5 days
	Mechanization in Sericulture	4 days

Integrated Skill Development Scheme (ISDS)

S. D. Sharma, Ch. Sathyanarana Raju, Chikkanna, K. L Rajanna, K. N. Srikantaswamy, C. Parameshwara, A. S. Suma and R. S. Katiyar

Integrated Skill Development Scheme (ISDS) is the flagship scheme of Ministry of Textiles implemented by R&D Institutes of Central Silk Board, Bangalore for providing skill training to unemployed youths and prospective entrepreneurs

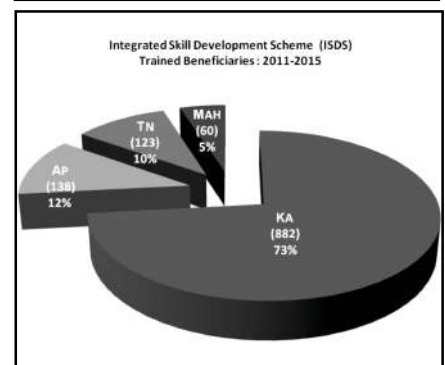
and is being implemented by CSRTI-Mysore since 2011. Skill training is provided on five topics viz., Commercial Chawki Rearing; Quality Bivoltine Cocoon Production; Cocoon Handicrafts; Mulberry Cultivation & Seed Multiplication; Mulberry and Silkworm Pests & Disease Management for 15 days. During the year a total of 499 beneficiaries were trained under the scheme.

Human Resource Development (2014-15)									
Prog.	Location	Trainees	State						Total
			KA	AP	TN	KER	MAH	Others	
MDP	CSRTI-Mysore	O	75	9	3				87
TUP	CSRTI-Mysore		110	43	19	10	87		269
	RSRSs & RECs	F	975	1320	1394		278	90	4057
ISDS	CSRTI-Mysore		258	108	93		40		499
ITP		O						17	17
NBT		O	39	7	15		7	57	125
		F	137	5	01		84	13	240
CC		O						26	26
Total			1594	1492	1525	10	496	203	5320

Programme	Training Location (Batches)	Trainees (No.)	Total
Commercial Chawki Rearing	CSRTI-Mysore (4)	70	91
	RSRS-Salem (1)	21	
Quality Bivoltine Cocoon Production	RSRS-Salem (2)	44	76
	CSRTI-Mysore (1)	32	
Mulberry Cultivation & Seed Multiplication	RSRS-Kodathi (3)	58	163
	RSRS-Ch. Nagar (2)	44	
	RSRS-Salem (1)	28	
	CSRTI-Mysore (1)	15	
	RSRS-Anantapur (1)	18	
Cocoon Handicrafts & Value Added Products	RSRS-Anantapur (3)	90	105
	RSRS-Ch. Nagar (1)	15	
Mulberry and Silkworm Pest & Disease Management	CSRTI-Mysore (2)	39	64
	RSRS-Kodathi (1)	25	

Impact of ISDS Training				
Yr.	Programme	Monthly Income (Rs.)		
		Before	After	% Improvt.
2013-14	Quality Bivoltine Cocoon Production	26675	32350	21.27
	Mulberry Cultivation & Seed Multiplication	18200	21750	19.51
	Commercial Chawki Rearing	31500	39850	26.51
	Cocoon Handicrafts & Value Products	5500	7500	36.36
	Avg.	20469	25363	23.91
2014-15	Quality Bivoltine Cocoon Production	27850	33200	19.21
	Mulberry Cultivation & Seed Multiplication	19150	22510	17.55
	Commercial Chawki Rearing	33450	41330	23.56
	Mulberry & Silkworm Pest & Disease Management	21870	27100	23.91
	Avg.	25580	31035	21.33

	Center	Total
RSRS-Kodathi	RSRS- Kodathi	270
	REC-Bidaraguppe	90
	REC-Chitradurga	90
	REC-Madivala	90
	REC SU-Kanakapura	60
	RECSU-Koppal	30
	RECSU-Tumkur	60
	RECSU-Ranebennur	60
	RECSU-Kudgi	15
	RSRS- Chamrajanagar	135
	REC-Kinkahally	45
	REC-Shimoga	30
RSRS-Anantapur	RSRS-Anantapur	75
	REC-V.Kota	90
	REC-Kalyandurga	75
	REC-Madakasira	75
	REC-Vikarabad	75
	REC-Giddalur	105
	REC-Rayachoty	75
	REC-Eluru	75
	REC-Penukonda	105
	REC-Atmakur	75
	RECSU-Bidar	75
	REC-SU-Hindupur	75
	RECSU-Palamaner	75
	RECSU-Chebrolu	75
	RECSU-Suryapet	120
RECSU-Metpalli	75	
RSRS-Salem	RSRS-Salem	180
	REC-SU-Berigai	75
	REC-Krishnagiri	150
	REC-Gobi	150
	REC-Udumalpet	150
	REC-Samayanallur	150
	REC-Srivilliputtur	147
	REC-Palakkad	150
	RECSU-Vaniyambadi	30
	RECSU-Kalpetta	60
RECSU-Avinashi	77	
RECSU-Trichy	75	
Nested Units	REC-Baramati	90
	REC-Amaravathi	45
	REC-Parbhani	53
	REC-Aurangabad	60
	REC-Jalna	30
	REC-Hoshangabad	90



International Training Programmes: Three Japan Overseas Cooperation Volunteers (JOCVs) viz., Mr. Yuki Yamanaka, Mr. Nozomu Aoki and Mr. Tadahiro Asai have been posted to India for two years by JICA to support CSB in extension activities in cluster promotion programme. JOCVs underwent an "Orientation Training in Sericulture" for 30 days at CSRTI-Mysore and posted to Hindupur, Ramanagaram and Hosur.

Special Training Programme on Silk and Sericulture Industry sponsored by International Technical & Economic Cooperation (ITEC) by Ministry of External Affairs: Govt. of India, New Delhi was initiated for 45 days. Fourteen trainees from Bangladesh, Uganda, Egypt, Philippines and Thailand are participating in the programme and it concludes on 22.04.2015.

Need-Based Training Programmes: CSRTI-Mysore trains sericulturists, unemployed youth, personnel from NGOs, Universities & DoS etc. in improved sericultural technologies and NBT programmes are organized to meet the specific requirements.

	Programme	Duration days	State					Others	Total
			KA	AP	TN	KER	MAH		
Officials	Orientation Programme (Insurance)		2	7	4	6	3	7	27
	Intensive Bivoltine Training	34	28		1			24	53
	PGDS	5						14	14
	Chawki Rearing	7						12	12
	Intensive Sericulture Training	15		2					2
	Silkworm Rearing & Molecular Biology	15			7				7
	Biochemical Methods	15	4						4
	Artificial Diet	4			1				1
	Silkworm Pathology	5		1				4	5
		Total		39	7	15	3	7	54
Farmers	Chawki Rearing	8	01			47			48
	Mulberry cultivation	5	01				10		11
	ITBS	90	06						6
	Awareness Programme	5				16			16
	CRC (Seed Act)	90	51						51
		30	71	05					76
	IBT	34	04		01		03		8
	Chawki & Late Age Rearing	10				21			21
	Seri Poly Clinic	4	03						3
	Total		137	05	01	84	13		240

Intensive Bivoltine Training Programme: Bivoltine hybrid silkworm rearings were organized to support all the courses (FC1 x FC2; 655 dfis; 7 batches) and an average cocoon yield of 74.78kg/100 dfis was recorded.

Performance of Bivoltine Hybrids (2014-15)							
Season	Dfils (No.)	Hatching (%)	SCW (g)	SSW (g)	Shell (%)	Yield/100 dfils (kg)	Rate/kg (Rs.)
April - May 2014	100	85.00	1.833	0.398	21.79	69.50	422.00
June - July 2014	100	98.00	1.937	0.390	20.67	92.50	350.10
July - Aug. 2014	75	90.00	1.521	0.320	21.13	47.03	320.00
Sept. - Oct. 2014	100	92.70	1.861	0.396	21.42	85.00	275.00
Oct. - Nov. 2014	80	96.00	1.982	0.441	22.25	70.95	290.10
Nov. - Dec. 2014	100	97.00	1.937	0.390	20.67	91.90	335.00
Jan. - Feb. 2015	100	92.10	1.701	0.300	17.13	66.60	300.00
Total	655	92.97	1.825	0.376	20.72	74.78	327.46

RSRS-KODATHI

REC & Sub-Units	Command Area	Staff	
RSRS-Kodathi	Karnataka	In-charge Officer :	Dr. K. L. Rajanna
REC-Bidaraguppe		Scientists :	14
REC-Chitradurga		Technical Staff :	19
REC-Madivala		Administrative Staff :	5
RECSU-Bijapur	Farm Based Units		
RECSU-Jamkhandi	Unit	Total Area (Acres)	Mulberry Acreage
RECSU-Kanakapura	RSRS-Kodathi	66.90	10.50
RECSU-Koppal	REC-Bidaraguppe	7.00	2.07
RECSU-Kudlagi	REC-Chitradurga	7.00	2.41
RECSU-Ranebennur	REC-Madivala	8.00	3.15
RECSU-Shahapur	RECSU-Koppal	8.00	1.50
RECSU-Shirahatti	Total	96.90	19.63
RECSU-Tumkur			

Collaborative Research Projects

RSRS-Kodathi is involved in collecting data on following collaborative projects with the main institute:

- MOE 3523: Study on Drought Management practices in Mulberry Sericulture
- ARP 3519: Silkworm Disease Monitoring of Seed and Commercial Crop Rearing of South Indian States
- AIB 3498: Popularization of Authorized Silkworm breeds among the farmers of South India
- SPT 0039: Identification of factors responsible for crop loss due to silkworm diseases at field level and its impact on cocoon productivity
- PPE 3455: Habitat studies - Impact of crop diversity on conservation and performance of natural enemies in mulberry ecosystem. The detailed report will be submitted by the PI from main institute
- PRE 3512: Studies on pest status and eco-friendly management of thrips (*Pseudodendrothrips mori*) (Thysanoptera: Thripidae) on mulberry in Tamil Nadu and Karnataka
- PRE 3527: Survey and surveillance of major pests and their natural enemies in mulberry eco-system
- Monitoring of soil fertility status of mulberry gardens in Karnataka, Andhra Pradesh & Tamil Nadu and creation of database
- Validation of new recommendation of fertilizers/manures for V1 mulberry under irrigated conditions
- Comparative study on the effect of split application of fertilizers in soli and liquid form on mulberry leaf yield, fertilizer saving, reduction in weed and pest incidence and rearing performance
- Studies on Disease forecasting and forewarning for Mulberry pests, diseases and Silkworm pests
- All India Co-ordinated Experiment for Mulberry (Phase-III) at REC-Madivala
- Large scale pre-authorization field trial of G4 at RSRS-Kodathi farm and farmers' fields
- Improvement of breed characteristics of L14 through multi-locational breeding approach
- Sericulture woman and Technology transfer - A group approach

Continuous/Other Activities

Extension Communication Programmes:

Various kinds of ECPs were conducted by the RSRS and its nested units for the transfer of technology developed by the main institute and are fine-tuned.

Centre	Tech. Demo.	Group Disc.	Aware. Prog.	Field Day	Enlight. Prog.	Exhibition	Study Tour
RSRS-Kodathi	257 (14)	731 (29)	408 (12)	368 (8)			302 (6)
REC-Bidaraguppe	66 (3)	151 (7)	40 (1)	30 (1)	150 (1)		52 (1)
REC-Chitradurga	79 (3)	147 (8)	55 (2)	185 (1)	387 (1)	120 (1)	20 (1)
REC-Madivala	49 (3)	152 (6)	133 (2)	563 (8)	204 (1)	110 (1)	100 (2)
RECSU-Bijapur		603 (21)	117 (2)				
RECSU-Jamkhandi		68 (2)	50 (1)				
RECSU-Kanakapura	75 (3)	323 (11)	86 (2)		128 (1)		47 (1)
RECSU-Koppal	31 (1)	233 (5)	22 (1)		138 (1)		47 (1)
RECSU-Kudlagi	20 (1)	156 (7)		199 (3)			50 (1)
RECSU-Ranebennur	47 (2)	244 (12)	91 (3)	29 (1)			50 (1)
RECSU-Shahapur		131 (6)					30 (1)
RECSU-Sirahatti		236 (7)	132 (3)	734 (2)			

Values represent farmers participated & figures in parentheses indicate number of events conducted

Transfer of Technology Programmes: The OFTs undertaken in transfer of technology programmes were evaluated for their impact based on benchmark/diagnostic study and the effectiveness of the technologies is presented below:

Centre	INM	IPM- Mulberry	IPM- Silkworm	Composting	Poshan	Navinya	Nemahari
RSRS- Kodathi	6	10					
REC-Bidaraguppe	5	10					
REC-Chitradurga				5 (6)			
REC-Madivala		10	30 (15300)				
RECSU-Kanakapura				5 (5)		103	10
RECSU-Ranebennur	2	7	63 (6800)				
RECSU-Tumkur	2		13 (1500)		5	53	
Total	15	37	106 (23600)	10 (11)	5	156	10

Values represent the number of beneficiaries

Values in parentheses indicate dfls covered (IPM-Silkworm) & acres covered (composting)

Popularization of Bivoltine Hybrids & Improved Crossbreed: A total of 40750 dfls of new bivoltine hybrids were distributed to the farmers and the average yield recorded was 70.65 kg/ 100 Dfls. A total of 10300 dfls of improved crossbreed, L14 x CSR2 was distributed to the farmers and the average yield recorded was 54.64kg/100 dfls.

Bivoltine Hybrids			
Unit	Farmers	Dfls	Yield/100 dfls(kg)
RSRS-Kodathi	4	1600	57.90
REC- Madivala	135	34150	66.90
CPP-Davengere	6	1000	59.80
REC-Koppal	14	3400	58.70
REC-Madiwala	4	600	
Total	163	40750	

ICB : L14 x CSR2			
Unit	Farmers	Dfls	Yield/100 dfls(kg)
RSRS-Kodathi	3	1000	65.60
REC- Madivala	23	5800	60.00
REC-Chitradurga	5	1000	54.76
RECSU-Kanakapura	10	1000	58.83
RECSU-Koppal	6	1500	34.00
Total	47	10300	54.64

Production of Biological Control Agents: A total of 820 pouches of *Nesolynx thymus* were produced on housefly pupa and distributed to stakeholders for the management of uzi fly.

Establishment of AMIT: Affordable Micro Irrigation Technology (Drum Kit Technology) and Drip Irrigation system was installed for four acres of mulberry garden at RSRS Kodathi to mitigate drought situation.

Cluster Promotion Programme (CPP): Bivoltine sericulture technologies were disseminated in 22 clusters across Karnataka and 77,29,782 dfls were brushed with an average yield of 65.67 kg/100 dfls, which is an achievement of 107.21% of the target.

Institute Village Linkage Programme (IVLP): A total of 38,800 dfls of bivoltine hybrids were reared under REC-Bidaraguppe and the average yield recorded was 61.23 kg/100 dfls, which is an improvement of 12.79% against benchmark.

Training Programmes @ RSRS-Kodathi & Nested Units				
Unit	CSS 2109		ISDS	
	Prog (Nos)	Beneficiaries (Nos)	Prog (Nos)	Beneficiaries (Nos)
RSRS-Kodathi			4	81
REC-Chitradurga			2	63
Total			6	144

RSRS-CHAMARAJANAGAR

REC & Sub-Units
RECSU-Kinakanahally

Command Area	Staff	
Karnataka	In-charge Officer :	Dr. K. Srikantaswamy
	Scientists :	4
	Technical Staff :	11
	Administrative Staff :	4

Unit	Total Area (Acres)	Mulberry Acreage
RSRS-Chamarajanagar		6.153
RECSU-Kinakanahally		

Ongoing Research Projects

PPF 3500: Development of Seri-lac culture model for income augmentation (Inter institutional Project with IINRG, Ranchi; Mar. 2013 to Dec. 2016)

V.Sivaprasad (Project Coordinator), R.Ramani¹, K. Srikantaswamy², Sibayan Sen, Mohanasundram¹

¹IINRG, Ranchi, ²RSRS Chamarajanagar

Objectives

- To work out the additional income generation out of lac production and its economics in relation to mulberry leaf production
- To find carbon sequestration rate in improving the soil fertility and for sustenance of crop productivity
- To generate employment for rural people and improve their livelihood
- To study the pest & disease incidence, cross infectivity studies in mulberry, lac host plant vice versa

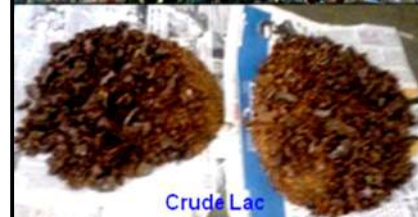
Flamingia spp. (Fabaceae), the lac host plants were maintained between the mulberry trees by following necessary cultural operations for better establishment. Lac insect (*Kerria lacca* L.) mother brood culture mass multiplied at IINRG, Ranchi was procured and inoculated on lac host plants for lac production. First lac production cycle was completed and the trial indicated that the climatic conditions (max. temp < 35°C) prevailing in the study area is supportive for the lac production. Brood lac samples from the brood culture, lac insect brood samples from the shoots were collected and sent to IINRG for identification of predators. Only one lac insect predator, which is host-specific, was recorded. Around 200-250g of stic lac was recovered from each plant and a quantity of 200-250kg lac /



Lac Host Plant



Stick Lac



Crude Lac

ac/yr was produced. An annual income of Rs.60000 to 75000/ac/yr could be realized. Further validation trials of Seri-Lac culture are under progress at RSRS unit and with farmers.

Considering the importance of lac production with mulberry as an intercrop in augmenting farmers' income, a farmer Sri Mahesh (Tumbala village; T.Narasipura taluq) was identified for taking up the Seri-Lac crop-system. The famers' land is characterized as red soil with low pH (~7.0) and mulberry is planted as tree plantation

(8' x 8' spacing). Between the rows of mulberry, 500 lac host plant seedlings were transplanted. Necessary care was taken for establishment of lac host plant and > 98% survival with good growth was recorded. Lac culture multiplied at IINRG Ranchi was procured and inoculated to lac host plants and the first crop lac production cycle is in progress. Soil samples were also collected to study the initial fertility status.

The first lac production cycle clearly indicates potentiality to exploit with mulberry in wider spacing for income augmentation in Chamarajanagar area. Secondly, being leguminous crop, lac host plant could facilitate reduction of synthetic nitrogen fertilizer application to get sustainable mulberry leaf production. Mulching of *Flamingia* crop residue would help in improving soil profile.

RSRS-Chamarajanagar is also involved in collecting data on the following collaborative projects:

- Forecasting and forewarning of mulberry pests
- OST of newly developed silkworm hybrids

Continuous/Other Activities

Evaluation of RC1 and RC2 genotypes under water stress condition

K. Srikantaswamy

New rainfed mulberry varieties (RC1 & RC2) were evaluated with two farmers (Sri. K. Chennappa, Kelasurpura and Sri.M.K. Mahadevashetty, Mangala; 0.75 acre each). Four crops leaf yield data (2514 kg/ac/crop in RC1 and 2302 kg/ac/crop in RC2) against the check variety S13 (2177 kg/crop) was recorded with an improvement of 15.48% and 5.74% in RC1 and RC2, respectively. The average cocoon yield recorded was 60-73 kg/100 dfls over the bench mark yield (40 kg/100 dfls with Local/K2 variety). Overall sixteen crop leaf yield indicates that RC1 has shown higher yield (1860.13 kg/acre/crop) followed by RC2 (1846.88 kg/acre/crop) against 1517.13 kg/acre/crop in S13.

Testing of three-way cross bivoltine hybrids

R. Meenal and K. Srikantaswamy

Objective: To evaluate new three way cross bivoltine hybrids for its suitability

On-Station Trial (OST) was conducted with newly developed three-way cross bivoltine hybrids (FC1 x CSR2 & FC3 x CSR17) with FC1 x FC2 (double hybrid) and CSR2 x CSR4 (single hybrid) as controls. The three-way cross hybrid, FC1 X CSR2 & FC3 x CSR17 shown higher ERR by number and weight; cocoon weight; shell weight; shell ratio in comparison to control hybrids. Similarly, the new hybrids had shown comparatively higher than the control hybrids.

Economics of Seri-Lac Crop System				
Input Costs (Rs.)	Lac Host Plant Cultivation		Mulberry Cultivation	
	FYM (2MT)	2000	FYM (4 MT)	4000
	Fertilizers	1600	Fertilizer	1600
	Labour	1600	Labour	2600
	Misc.	2300	Misc.	2500
Total	7500	Total	11000	
	Lac Production	NIL	Cocoon Production	50000
Returns (Rs.)	@ 200 g/plant x 1000 plants	200kg	4 Crops/Year (840 Dfls) @ 70kg/100 dfls	590kg
	Lac Sale @ Rs 400/kg	80000	Cocoon Sale @ Rs. 300/kg	177000
Profit	72500		116000	
Net Returns from Seri-Lac Crop System/Acre/Year = Rs. 1,88,500				

Hybrid	Yield /10000 Larvae		Single Cocoon Wt.(g)	Single Shell Wt.(g)	Shell Ratio (%)
	No.	Wt.(kg)			
FC1 x CSR2	5813	10.188	1.520	0.323	20.65
FC1 x FC2 (C)	5150	8.869	1.472	0.289	19.61
FC3 x CSR17	6413	10.050	1.623	0.351	21.70
CSR2 x CSR4 (C)	5950	9.813	1.591	0.342	21.48

Promotion and evaluation of mulberry tree plantation technology for sustainable sericulture development under rain fed conditions

K. Srikantaswamy

Objective: Reviving rain fed mulberry sericulture by mulberry tree plantation with AMIT at farmer's field

Mulberry tree plantation was undertaken with five farmers' @ one acre each and drum kits were supplied to raise mulberry as successful tree for protective irrigation. The survival percentage ranged from 90 to 100% and significant improvement over the local practice in growth associated parameters was recorded one year after the establishment of mulberry tree plantation utilizing AMIT.

Mulberry Growth	AMIT	Local Practice	t-value
No. of shoots/plant	17	7	31.76**
Total shoot length (cm)/plant	3184	751	31.40**
Total leaves/plant	840	169	23.60**
Leaf area (m ²)	13.6	1.26	29.12**
Leaf area index	2.23	1.56	7.46**
Leaf weight (gm/plant)	2.95	0.47	13.09**
Leaf yield (kg/acre/year)	10647	7045	4.30**

Organic Farming in Mulberry

K. Srikantaswamy and S.N. Pallavi

Objective: Transfer of organic farming technology to farmers

Organic farming for sustainable mulberry leaf production was assessed at four farmer's field (V-1 mulberry variety; IJS and 4' x 4' spacing; irrigated; one acre/farmer). Critical inputs (5kg Azotobacter; 1kg PSB Bio-fertilizer; 1l Poshan) were applied and Soil samples were collected to study the soil fertility status. Average leaf yield recorded (ten crops) 9755 kg/ha/crop in organic plots as against the bench mark of 8500 kg/ha/crop with an improvement of 14.76%.

Farmer	Leaf Yield/ha/crop(kg)	Rearing Performance		
		Dfls Reared	Hybrid	Cocoon Yield/100 dfls (kg)
Basavaraju (Muttathi)	8340	300	BV	80.00
	6930	175		53.14
	9965	350		90.00
Puttathayamma (Muttathi)	6930	175	BV	52.57
	8965	300		88.33
Ravikumar (Kalihundi)	11435	50	CB	76.00
	10340	50		72.00
	9965	50		90.00
Puttaswamy (Bagali)	14153	100	BV	52.10
	14527	75	CB	77.33

Multiplication of parental stocks for seed production

R. Meenal and K. Srikantaswamy

Bivoltine breeds (FC3, FC4, CSR16 & CSR17) were reared at RSRS for basic seed cocoon generation for seed production. Two crops failed due to flacherie and grasserie and the third crop (25 dfls each; FC3 & FC4) generated 47.40 and 65.00 kg/100 dfls, respectively.

Transfer of Technology Programmes: The OFTs undertaken in ToT programmes were evaluated for their impact based on benchmark/diagnostic study.

Centre	INM	IPM-Mulberry	IPM-Silkworm
RSRS-Chamarajnagar	5	25 (54.5)	70 (5850)

Technology	Impact Analysis
INM	Reduction in soil pH; increased OC content; 25% reduction in chemical fertilizers; improvement in leaf yield (17%) & cocoon yield (26%)
IPM-Mulberry	Reduction in tukra infestation - 4.12% from 20%
IPM-Silkworm	Reduction in uzi incidence - 4.14% from 10.06%

Extension Communication Programmes (ECP)

Various kinds of ECPs were conducted for the transfer of technology developed by the main institute and are fine-tuned.

Centre	Group Disc.	Aware. Prog.	Field Day	Exhibition	Study Tour
RSRS-Chamarajnagar	269 (9)	748 (9)	263 (5)	1447 (1)	25 (1)

Production of Biological Control Agents: Sixty seven boxes of *S. coccivora* were produced against the target of 60 boxes and 51 boxes were supplied to 25 farmers covering 54.50 acres of mulberry for the control of tukra.

Cluster Promotion Programme (CPP): Bivoltine sericulture technologies were disseminated in 22 clusters across Karnataka and 77,29,782 dfls were brushed with an average yield of 65.67 kg/100 dfls, which is an achievement of 107.21% of the target.

Institute Village Linkage Programme (IVLP): A total of 38,800 dfls of bivoltine hybrids were reared under REC-Bidaraguppe and the average yield recorded was 61.23 kg/100 dfls, which is an improvement of 12.79% against benchmark.

Training Programmes @ RSRS- Chamarajanagar				
Unit	CSS 2109		ISDS	
	Prog (Nos)	Beneficiaries (Nos)	Prog (Nos)	Beneficiaries (Nos)
RSRS- Chamarajanagar			3	59

RSRS-SALEM

REC & Sub-Units
Tamil Nadu
Samayanallur
Krishnagiri
Udumalpet
Gobichettipalayam
Sub Unit-Berigai
Sub Unit-Srivilliputtur
Sub Unit-Vaniyambadi
Sub Unit-Tiruchirappalli
Sub Unit-Avinashi
Kerala
Palakkad
Sub Unit-Kalpetta

Command Area	Staff	
Tamil Nadu Kerala	In-charge Officer :	Dr. Chikkanna
	Scientists :	29
	Technical Staff :	24
	Administrative Staff :	20

Unit	Total Area (Acres)	Mulberry Acreage
RSRS-Salem	20.0	3.4
REC-Krishnagiri	2.77	2.5
REC-Samayanallur	2.62	0.6

Research Projects

PRE 3512: Studies on pest status and ecofriendly management of thrips (*Pseudodendrothrips mori*) (Thysanoptera: Thripidae) on mulberry in Tamil Nadu and Karnataka (in collaboration with NBAIR, Bangalore; April 2014 to March 2016)

S. Mahiba Helen (PI), Chandish R. Ballal¹, N. Dhahira Beevi², M. Noble Morrison³, Chikkanna

¹NBAIR, Bangalore; ²REC, Gobichettipalayam; ³REC, Madivala

Objectives:

- Survey on infestation of thrips on mulberry in selected sericulture areas of Tamil Nadu and Karnataka
- Laboratory evaluation of the efficacy of different bio-control agents
- Laboratory and field evaluation of potential natural enemies
- Evaluation of the establishment and impact of natural enemies in the selected mulberry gardens

Surveys were conducted at fortnight intervals at farmers' gardens (Ithalahalli and Siddalaghatta areas in Karnataka; D. Perumapalayam, Karipatti and Thanneerpandalpudur, Pallipalayam and Chellakumarapalayam in Tamil Nadu). High incidence @ 11-30 thrips/leaf was recorded in Salem and Gobi area during December. Significant difference with Maximum temperature (0.824) correlated with thrips incidence in Siddalaghatta. A predatory mite (*Polyphagotarsonemus* sp.) and predatory thrips (*Scolothrips* sp. and *Aeolothrips* sp.) feeding on mulberry thrips was collected from Salem

and Gobichettipalayam. The specimens are being sent for identification to Zoological Survey of India, Kolkata by NBAIR, Bangalore. A predatory mite (Tenopodidae sp.) and three species of anthocorid predators (*Orius maxidentex*, *Orius dravidiensis* Muraleedharan and *Montandoniola indica* Ghauri) are identified by NBAIR, Bangalore.

Continuous/Other Activities

Monitoring the spread of papaya mealybug and mass production of its parasitoid

S. Mahiba Helen and Chikkanna

Objectives

- Mass production and supply of papaya mealy bug parasitoids, *Acerophagus Papayae* and *Pseudleptomastix mexicana*
- Impact analysis of parasitoid in the management of papaya mealybug

Papaya mealybug parasitoids, *Acerophagus papayae* (1,40,000) and *Pseudleptomastix mexicana* (9,000) were supplied to 650 sericulture farmers through DOS / RECs for the management of papaya mealybug in Udumalpet, Erode, Karur, Salem, Namakkal, Thiruvannamalai, Viluppuram, Tirupur, Madurai, Trichy, Dharmapuri, Dindigul, Krishnagiri and Tirunalveli districts of Tamil Nadu and Palakkad district of Kerala. Above 95% reduction in the papaya mealybug population was achieved following the introduction of exotic parasitoids.

Collaborative Research Projects/Programmes

- MOE 3523: Study on Drought Management practices in Mulberry Sericulture
- ARP 3519: Silkworm Disease Monitoring of Seed and Commercial Crop Rearing of South Indian States
- Monitoring of soil fertility status of mulberry gardens in Karnataka, Andhra Pradesh & Tamil Nadu and creation of database
- Validation of new recommendation of fertilizers/manures for V1 mulberry under irrigated conditions
- Comparative study on the effect of split application of fertilizers in soli and liquid form on mulberry leaf yield, fertilizer saving, reduction in weed and pest incidence and rearing performance
- Studies on Disease forecasting and forewarning for Mulberry pests, diseases and Silkworm pests
- All India Co-ordinated Experiment for Mulberry (Phase-III) at REC, Krishnagiri
- Large scale pre-authorization field trial of G4 at RSRS-Salem farm and farmers' fields

Transfer of Technology

On-Station-Trials (C. A. Mary Flora and Chikkanna)

Testing of Improved Cross Breeds: Three trials of two Improved Cross Breeds (L14 x CSR50 & NDV6 x CSR51) are undertaken (March-April 2014, August-September 2014 and October-November 2014).

Hybrid	Fec.	Yield/50K Eggs (kg)	SCW (g)	SSW (g)	SR (%)	Reelability (%)	AFL (m)	Renditta	Raw Silk (%)
L14 x CSR50	564*	63.06	1.884	0.398	21.13	83.68	913.76	6.67	15.03
NDV6 x CSR51	572	58.49	1.918	0.405	21.12	84.82	979.79	6.63	15.12
L14 x CSR2 (C)	542	67.22	1.926	0.398	20.66	78.74	924.65	7.08	14.23
PM x CSR2 (C)	516	73.73	1.837	0.352	19.16	80.17	748.23	7.84	12.87

* Values represent an average of three trials

Testing of New Bivoltine Hybrids: Three trials of two new bivoltine hybrids, 2C x 4S (single hybrid developed at SSBS, Coonoor) and G11 x G19 (double hybrid developed at CSRTI, Mysore) are undertaken in different seasons (March-April 2014, August-September 2014 and October-November 2014). Another set of bivoltine hybrids (Double hybrids: DH1, DH2, DH3 and DH4; Single hybrid: D2 x D13) developed at SSBS Coonoor were also test verified (October-November 2014 and January-February 2015).

Hybrid	Season	Yield/50K Eggs (kg)	SCW (g)	SSW (g)	SR (%)	Reelability (%)	AFL (m)	Renditta	Raw Silk (%)
2C x 4S	Mar-Apr 14	37.31	1.323	0.295	22.30	70.34	756	7.18	13.92
	Aug-Sept 14	36.13	1.657	0.341	20.58	74.37	939	6.50	15.38
	Oct-Nov 14	71.87	1.822	0.359	19.70	88.22	923	6.92	14.45
	Mean								
CSR2 x CSR4 (Control)	Mar-Apr 14	31.90	1.310	0.306	23.36	68.62	763	6.81	14.74
	Aug-Sept 14	40.86	1.533	0.339	22.11	72.84	908	6.74	14.91
	Oct-Nov 14	71.05	1.822	0.388	21.29	79.11	911	6.41	15.60
	Mean								
G11 x G19	Mar-Apr 14	37.83	1.351	0.292	21.61	66.35	745	7.26	13.83
	Aug-Sept 14	24.84	1.673	0.352	21.04	77.38	912	6.61	15.13
	Oct-Nov 14	52.22	1.795	0.367	20.44	90.90	1083	5.95	16.79
	Mean								
FC2 x FC1 (Control)	Mar-Apr 14	48.71	1.436	0.308	21.45	90.42	1003	5.96	16.77
	Aug-Sept 14	75.39	1.759	0.398	22.63	77.75	1145	5.85	17.11
	Oct-Nov 14	68.16	1.781	0.396	22.23	79.61	1061	5.89	16.98
	Mean								

Hybrid	Yield/50K Eggs (kg)	SCW (g)	SSW (g)	SR (%)	Reelability (%)	AFL (m)	Renditta	Raw Silk (%)
DH1	81.43	1.908	0.417	21.85	85.30	1204.40	5.59	17.90
DH2	74.60	1.886	0.432	22.91	88.90	1108.22	5.97	16.77
DH3	84.17	1.952	0.442	22.64	89.13	1136.90	6.02	16.62
DH4	75.02	1.844	0.425	23.05	91.89	1126.22	6.42	15.59
FC1 x FC2 (Control)	70.21	1.874	0.420	22.41	86.09	1094.08	6.31	15.85
D2 x D13	65.73	1.951	0.421	21.58	85.13	1102.17	5.96	16.77
CSR2 x CSR4 (Control)	65.15	1.886	0.411	21.79	83.85	966.46	5.61	18.43

Values represent an average of two seasons

On-Farm-Trials: Newly developed silkworm hybrids (improved crossbreeds and bivoltine double and single hybrids) were test verified with the farmers by the RSRs and its nested units.

Unit	Hybrid Combination	Dfls (No)	Farmers (No)	Yield/100 Dfls(kg)
RSRS-Salem	L14 x CSR2	4050	23	59.20
	MV1 x S8	8400	45	70.00
	CSR50 x CSR51	2000	10	79.00
	G11 x G19	500	3	60.50
REC-SU-Berigai	S8 x CSR16	500	2	82.00
	G11 x G19	300	2	61.00
	L14 x CSR2	2300	11	58.00
	CSR16 x CSR17	1200	6	52.50
REC-Gobi	FC3 x FC4	7850	37	67.76
	L14 x CSR2	500	4	57.80
REC-Udumalpet	MASN4 x CSR4	500	5	65.20
RECSU-Kalpetta	CSR16 x CSR17	850	15	80.38
REC-Srivilliputtur	G11 x G19	4000	20	65.60
REC-Samayanallur	L14 x CSR2	500	3	66.40
RECSU-Trichy	FC3 x FC4	2000	9	68.40
	CSR16 X CSR17	2000	10	65.90
	G11 x G19	1500	10	69.30

Extension Communication Programmes:

Various kinds of ECPs were conducted by the RSRS and its nested units for the transfer of technology developed by the main institute and are fine-tuned.

Centre	Tech. Demo.	Group Disc.	Aware. Prog.	Field Day	Enlight. Prog.	Exhibition	Study Tour
RSRS-Salem	61 (3)	94 (4)	507 (5)	44 (1)	100 (1)	4500 (4)	29 (1)
REC-Gobichettipalayam	58 (2)	235 (7)	95 (3)	44 (2)	124 (1)	167 (2)	40 (1)
REC-Krishnagiri	50 (2)	93 (4)	57 (2)	65 (2)	75 (1)	50 (1)	
REC-Samayanallur	68 (4)	130 (6)	107 (3)	117 (3)	491 (3)	188 (4)	40 (2)
REC-Srivilliputhur	30 (11)	108 (4)	199 (5)	65 (2)	180 (2)	29 (1)	25 (1)
REC-Udumalpet	35 (2)	288 (14)	234 (6)	246 (7)	501 (3)	504 (3)	
RECSU-Avinashi	50 (3)	71 (4)	59 (2)		105 (1)	105 (1)	
RECSU-Berigai	46 (3)	73 (4)	55 (2)	25 (1)	90 (1)		
RECSU-Trichy	44 (2)	150 (6)	128 (4)	65 (2)	311 (3)	158 (2)	17 (1)
RECSU-Vaniyambadi	62 (3)	99 (4)	81 (2)	60 (2)	101 (1)	30 (1)	
REC-Palakkad	35 (2)	67 (4)	270 (5)	55 (2)	81 (1)	1000 (3)	50 (1)

Values represent farmers participated & figures in parentheses indicate number of events conducted

Transfer of Technology Programmes: The OFTs undertaken in transfer of technology programmes were evaluated for their impact based on benchmark/diagnostic study and the effectiveness of the technologies is presented below:

Centre	INM	IPM Mulberry	IPM Silkworm	Composting	Poshan	Navinya	Nemahari
RSRS-Salem		50	80 (56725)		9	5	5
REC-Gobichettipalayam	5	31	65 (41000)	8 (20)	11	11	2
REC-Krishnagiri		4	6 (1000)	3 (7.5)	5	4	
REC-Samayanallur	5	12	30 (13775)	7 (7)	9	7	1
REC-Srivilliputhur	7	10		4 (10)	10	8	
REC-Udumalpet	7	15	25 (10000)	7 (17.5)	13	15	
RECSU-Avinashi	3	5	5 (1000)	3 (7.5)	10	2	
RECSU-Berigai	2		10 (1000)	2 (5)	4	1	
RECSU-Trichy	3	5		1 (2)	4	1	2
RECSU-Vaniyambadi	3		1 (500)		3		
REC-Palakkad	3	19			4	1	

Values represent the number of beneficiaries

Values in parentheses indicate dfls covered (IPM-Silkworm) & acres covered (composting)

Technology	Impact Analysis
INM	Reduction in soil pH; increased OC content; 25% reduction in chemical fertilizers
IPM-Mulberry	Reduction in leaf weber and tukra infestation - 2.5% from 10%
IPM-Silkworm	Reduction in uzi incidence - 1.62% from 7.45%
Composting	Popularization of organic manures
Poshan	16% higher leaf yield and improvement in leaf quality
Navinya	70% recovery of the root-rot affected plants
Nemahari	6-7.28% decrease in root-knot & improvement in leaf yield by ~10%

Resham Krishimela/Workshops

Farmers Workshop (Salem; 14-06-2014)	Resham Krishimela (Virudhnagar; 05-07-2014)	Seed Act Programme (Krishnagiri; 10-12-2014)
298 farmers including 110 new farmers attended	750 farmers attended Booklet on Organic Mulberry Cultivation was released	157 farmers 123 CSB/DOS officials, 8 Dignitaries, Advanced Technology for Silkworm Seed Cocoon Production FAQ on Seed Act Book Released

Popularization of Improved Mulberry Varieties & Bivoltine Hybrids: A total of 2675 acres were planted with improved mulberry variety with 2087 farmers. A total of 24.27 lakh dfls of CSR single and double hybrids were distributed to the farmers in non-captive area and the average yield recorded was 70.65 kg/ 100 Dfls.

Improved Mulberry Varieties		
Unit	Farmers	Acres
RSRS-Salem	900	600
REC-Krishnagiri	203	309
REC-Samayanallur	42	79.5
REC-Udumalpet	208	381.95
REC-Gobi	141	347.50
RECSU-Berigai	158	274
RECSU-Srivilliputhur	41	69
RECSU-Vaniyambadi	55	48
RECSU-Avinashi	260	455
RECSU-Trichy	46	76.5
REC-Palakkad	21	21
RECSU-Kalpetta	12	14
Total	2087	2675.45

Bivoltine Hybrids			
Unit	Farmers	Dfls	Yield/ 100 dfls (kg)
RSRS-Salem	282	56725	72.00
REC-Samayanallur	649	100925	74.30
REC-Udumalpet	6	1200	52.50
REC-Gobi	11416	2259715	77.20
RECSU-Trichy	69	7450	67.50
RECSU-Kalpetta	15	850	80.38
Total	12437	2426865	70.65

Cluster Promotion Programme: Bivoltine sericulture technologies were disseminated in 28 clusters across Tamil Nadu and two clusters in Kerala. 60.36 lakh dfls of bivoltine hybrids were reared with an achievement of 115 % against the target of 52.25 lakh dfls and recorded highest cocoon yields (75.4 kg/100 dfls) in the country. The raw silk production achieved was 692 MT against the target of xxxxxxMT and contributed 17.88 % to the bivoltine raw silk production in the country.

Adharshgram (IVLP): A total of 1,17,487 dfls of bivoltine hybrids were reared with 200 farmers in two clusters (Sathyamangalam & Thondamuthur) and the average yield recorded was 71.1kg/100 dfls, which is an improvement of 12.9% against the benchmark.

Training Programmes at RSRS-Salem & Nested Units				
Unit	CSS 2109		ISDS	
	Prog (No.)	Beneficiaries (No.)	Prog (No.)	Beneficiaries (No.)
RSRS-Salem	6	100	1	29
REC-Gobi	1	41	1	15
REC-Samayanallur	2	56		
REC-Srivilliputtur			1	21

RSRS-ANANTAPUR

Command Area	Staff	
	In-charge Officer :	Dr. Satyanarayana Raju
Andhra Pradesh	Scientists :	18
Telangana	Technical Staff :	21
Karnataka	Administrative Staff :	19

Farm Based Units		
Unit	Total Area (Acres)	Mulberry Acreage
RSRS-Anantapur	40.73	3.5
REC-Rayachoty	5.00	1.0
REC-Vikarabad	5.50	1.8
RECSU-Bidar	11.33	5.5

REC & Sub-Units
Andhra Pradesh State
V.Kota
Madakasira
Eluru
Kalyanadurgam
Sub Unit-Chebrolu
Sub Unit-Atmakuri
Sub Unit-Bhimadole
Sub Unit-Giddalur
Sub Unit-Penukonda
Sub Unit-Hindupur
Sub Unit-Palamaner
Sub Unit-Kalyanadurgam
Telangana State
Sub Unit-Surya Peta
Sub Unit-Met Palli

Research Projects

MIP (A) 5001: Evaluation of elite mulberry varieties under semi-arid agro climatic conditions.

M. A. Shanthan Babu (PI) and Ch. Satyanarayana Raju (Co-coordinator)

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.

Methodology

- Four test varieties viz., G2, RC1, RC2 and Taiwan Variety
- Evaluation of mulberry varieties under Randomized Block Design
- Raising of saplings of elite mulberry varieties in nursery beds
- 0.7 acre land preparation for experiment.
- V1 variety as National Check and Anantha variety as Local Check
- Replications: 4 / accession
- No. of Plants/replication: 64 plants
- Spacing: 90 x 90 cm
- Inputs: FYM @ 25 tons/ha/year in two split doses, NPK @ 350:140:140 kg/ha/year in 5 split doses
- No. of crops/year: 5 crops
- Pruning method: Leaf harvest followed by bottom pruning after each crop
- Crop data recording for 3 years with a minimum of 12 crops on growth and yield parameters for the entire project period
- One bioassay with bivoltine hybrid rearing during October-November in the III year of evaluation

Four leaf yield crops were recorded during the period under report. Average data of four crops on growth and leaf yield attributing parameters on mulberry genotypes under Evaluation of Elite mulberry varieties under semi- arid agro-climatic conditions during April, 2014 to March, 2015 is given below.

Growth and leaf yield attributing parameters on mulberry genotypes under semi-arid agro-climatic conditions [Apr. 2014 to Mar. 2015] (Average of 4 crops)

Genotype	No. of branches	Total shoot length (cm)	No. of leaves/m length of shoot (cm)	Leaf Moisture content (%)	MRC (%)	Leaf yield kg/ha/crop	Leaf shoot ratio
MV1	6.57	924.25	19.87	71.83	73.95	8775.36	0.64
MV2	6.34	1094.37	20.25	71.93	71.56	9171.65	0.65
MV3	6.25	1025.18	20.00	70.88	70.70	7804.56	0.62
MV4	5.83	867.31	19.87	71.08	71.41	7060.72	0.52
MV5	6.81	1109.66	21.00	74.03	72.26	8630.69	0.67
MV6	5.91	801.28	18.50	69.47	68.56	7018.91	0.56
CD at 5%	0.45	14.58	1.82	6.97	6.23	87.50	0.044
CV	6.17	8.78	6.53	10.64	7.25	11.40	6.44

Growth and leaf yield attributing parameters on mulberry genotypes under semi-arid agro-climatic conditions [Project period upto March, 2015] (Average of 7 crops)

Genotype	No. of branches	Total shoot length (cm)	No. of leaves/m length of shoot (cm)	Leaf Moisture content (%)	MRC (%)	Leaf yield kg/ha/crop	Leaf shoot ratio
MV1	6.54	909.15	19.91	71.48	76.26	8886.18	0.63
MV2	6.30	1079.90	20.46	71.58	74.81	9049.07	0.61
MV3	6.01	961.00	20.50	70.53	74.62	7508.53	0.59
MV4	5.77	832.87	20.40	71.14	74.93	6789.38	0.48
MV5	6.46	1032.71	20.84	73.23	75.22	8202.53	0.63
MV6	5.68	767.70	19.23	69.24	72.39	6797.38	0.55
CD at 5%	0.48	14.81	1.90	6.88	6.36	88.01	0.045
CV	6.21	8.92	6.71	10.71	7.31	11.32	6.54

All India coordinated experimental trial for mulberry varieties (AICEM) – Phase III (2011-2015).

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

Objectives

- To evaluate identified mulberry varieties under varied agro-climatic conditions to assess the growth and leaf yield potential of the varieties for authorization.

Methodology

Test varieties : MV1, MV2, MV3, MV4
 Check variety : V1
 No of replications : 6
 Experimental Design : RBD
 Spacing : 90 x 90 cm

Four leaf yield crops were recorded during the year report. Average data of Four crops on growth and leaf yield attributing parameters of different mulberry genotype under AICEM during April, 2014 to March, 2015 is given below.

Growth and leaf yield attributing parameters on mulberry genotypes under semi-arid agro-climatic conditions [Apr. 2014 to Mar. 2015] (Average of 4 crops)

Genotype	No. of branches	Total shoot length (cm)	No. of leaves/m length of shoot (cm)	Leaf Moisture content (%)	MRC (%)	Leaf yield kg/ha/crop	Leaf shoot ratio
MV1	7.26	818.90	18.76	72.66	79.12	7555.50	0.70
MV2	8.45	960.52	19.95	72.04	78.16	10234.17	0.67
MV3	8.10	849.84	19.39	70.98	79.57	8348.90	0.67
MV4	7.90	917.74	19.48	72.58	78.40	9674.80	0.63
MV5	8.85	986.19	19.69	71.74	80.30	9213.96	0.69
CD at 5%	0.41	2.38	0.49	6.75	7.45	92.70	0.07
CV	6.48	10.58	4.85	8.80	10.85	6.43	9.26

Average data on growth and leaf yield attributing parameters on mulberry genotypes under AICEM- Phase - III during Project period upto March,2015 (Average of 7 crops)

Genotype	No. of branches	Total shoot length (cm)	No. of leaves/m length of shoot (cm)	Leaf Moisture content (%)	MRC (%)	Leaf yield kg/ha/crop	Leaf shoot ratio
MV1	7.31	710.39	17.79	72.33	82.25	6907.00	0.69
MV2	7.94	876.13	19.86	72.64	80.02	9667.03	0.66
MV3	6.67	788.61	19.60	71.05	81.33	7884.96	0.66
MV4	7.40	831.63	19.46	72.34	82.00	9381.85	0.61
MV5	7.66	913.50	19.62	72.31	83.03	9086.88	0.63
CD at 5%	0.47	2.63	0.80	7.21	7.75	88.30	0.06
CV	7.181	11.83	14.82	10.22	11.54	10.25	10.24

Research Projects in Sericulture

Project Coordinators: Dr. M. Raghupathi (P.I.), Dr .N. Sivarami Reddy (C.I) and Ch. Satyanarayana Raju (Coordinator).

On-Station trials

Objectives: To test verify the new bivoltine x bivoltine hybrids developed by CSRTI, Mysore under On-Station Trial programme suitable to conditions of Andhra Pradesh.

Due to severe water problem prevailing in this station, quality mulberry leaf could not produced. Hence, silkworm rearings were not conducted in Sericulture Section of RSRS, Anantapuramu during the period.

Research Projects in Extension

PRE 3527: Survey and surveillance of major pests and their natural enemies in mulberry eco- system

B. Ksai Reddy and Ch. Satyanarayana Raju

The Project work was initiated in the month of January, 2015. Six fortnightly surveys conducted and recorded the data. The data showed that tukra infestation is 4.0 to 8.0%, leaf roller- 3.0 to 5.0%, Thrips- 5.0 to 13.0% and BHC -1.0 to 1.5% and submitted the data to PML Section, CSRTI, Mysore.

Other Programmes:

Production of *N. thymus* at RSRs, Anantapuramu for control of Uzi fly infestation on silkworm crop in the field

M. Raghupathi and Ch. Satyanarayana Raju (Coordinator)

N. thymus was produced using house fly pupa and supplied to different areas as per their requirement. The produced parasitized house fly pupae were sold to different areas and also used for a demo on Uzi fly parasitoid combined with Uzi trap where 263 farmers were benefited through this programme. The following are the details of supply of *N. thymus*. 1119 pouches of *N. thymus* (50 ml, 2000 pupa) were supplied. Data was collected on the suppression of Uzi indicated that there was a significant decrease in the Uzi infestation (9.6% vs. 3.0%) through integrated control measures adopted.

Soil testing laboratory

B. Kasi Reddy and Ch. Satyanarayana Raju (Coordinator)

335 Soil samples were collected from the farmers of CPP and IVLP of Kadapa Chittoor, Ranga Reddy, East Godavari and Anantapur districts. The most of the soils of Andhra Pradesh were slightly alkaline in nature and poor in organic content. Farmers advised to go for growing of green manure in two times in a year.

On-Farm-Trials: Newly developed silkworm hybrids (improved crossbreeds and bivoltine double and single hybrids) were test verified with the farmers by the RSRs and its nested units.

Unit	Hybrid Combination	Dfls (No)	Farmers (No)	Yield/100 Dfls(kg)
REC- V. Kota	MASN4 x CSR4	500	2	72.80
	S8 x CSR16	200	1	72.10
	CSR16 x CSR17	29750	52	71.00
	G11 x G19	1000	3	72.00
RECSU-Penukonda	FC3 x FC4	8400	39	68.00
	CSR16 CSR17	6500	27	64.00
	L14 x CSR2	300	2	44.30
REC-Madakasira	CSR16 x CSR17	2750	7	65.76
	FC3 x FC4	450	2	64.70
	L14 x CSR2	3200	8	56.72
RECSU, Chebrolu	CSR16 CSR17	32700	45	55.97
	L14 x CSR2	200	1	49.00
REC- Eluru	CSR16 x CSR17	37700	67	63.99
RECSU, Palamaner	CSR16 x CSR17	19000	32	63.80
	L14 x CSR2	500	2	58.20
RECSU, Hindupur	L14 x CSR2	2200	6	52.50
RECSU, Giddalur	L14 x CSR2	3400	9	51.87

Extension Communication Programmes:

Various kinds of ECPs were conducted by the RSRs and its nested units for the transfer of technology developed by the main institute and are fine-tuned.

Centre	Film Shows	Group Disc.	Aware. Prog.	Field Day	Enlight. Prog.	Exhibition	Study Tour
RSRS, Anantapur		31(1)			178(1)	550(1)	
REC, Eluru		60(2)	72(2)	66(2)	118(1)	650(2)	
REC, Kalyandurgam		154(6)	65(2)	66(2)	150(1)	275(2)	
REC, Madakasira	25(2)	45(2)	113(2)	120(2)		16(1)	
REC, Rayachoty	54(2)	45(2)	66(2)	61(2)	150(1)	30(1)	54(1)
REC, Vikarabad		48(2)	168(6)	24(1)		30(1)	30(1)
REC, V. Kota	120(2)	146(3)	220(3)	169(2)	377(2)	76(1)	49(1)
REC SU, Atmakur	62(2)	58(4)	111(3)	101(5)		32(1)	
REC SU, Bidar	412(2)	55(2)			1402(1)	412(2)	
REC SU, Chebrolu	31(1)	73(3)	85(3)	48(2)	417(2)	21(1)	
REC SU, Giddalur	45(2)	146(5)	230(5)	82(2)	104(1)	137(2)	57(1)
REC SU, Hindupur	50(2)	50(2)	84(2)	80(2)	150(1)	50(1)	24(1)
REC SU, Metpally	64(2)	124(4)	118(3)	36(2)		35(1)	99(2)
REC SU, Palamner	134(2)	46(2)	367(4)	74(2)	125(1)	125(1)	20(1)
REC SU, Penukonda	40(2)	45(2)	55(2)	50(2)	90(1)	90(1)	
REC SU, Suryapet	44(2)	76(6)	232(4)	50(2)	250(1)		76(2)
Total	1081(23)	1202(48)	1986(43)	1027(30)	3333(13)	1979(18)	409(11)

Values represent farmers participated & figures in parentheses indicate number of events conducted

Transfer of Technology Programmes: The OFTs undertaken in transfer of technology programmes were evaluated for their impact based on benchmark/diagnostic study and the effectiveness of the technologies is presented below:

Centre	INM	IPM Silkworm	Composting	Poshan	Navinya	Nemahari
RSRS, Anantapur	-	30(9,000)		2		
REC, Eluru	2		1(3)	1		
REC, Kalyandurgam	2	35(12,000)	1(4)	1		
REC, Madakasira	2	110(25,000)	1(2)	2		
REC, Rayachoty	2		1(3)	2		
REC, Vikarabad	2			2		
REC, V. Kota	4		1(2)	2	5	
REC SU, Atmakur	2			1		
REC SU, Bidar	1			1		
REC SU, Chebrolu	4		1(5)	1	5	
REC SU, Giddalur	2	25(9,000)		1	5	5
REC SU, Hindupur	2	20(8,000)	1(4)	1		
REC SU, Metpally	2			1		
REC SU, Palamner	2		1(5)	1		
REC SU, Penukonda	2	50(15,000)		1		
REC SU, Suryapet	2		1(2)	1		
Total		270(73,000)	10(31)	21	15	5

Values represent the number of beneficiaries

Values in parentheses indicate dfls covered (IPM-Silkworm) & acres covered (composting)

Technology	Impact Analysis
INM	Reduction in soil pH; increased OC content; 25% reduction in chemical fertilizers
IPM-Mulberry	Reduction in leaf Webber and tukra infestation - 2.3% from 10%
IPM-Silkworm	Reduction in uzi incidence - 1.62% from 9.30%
Composting	Popularization of organic manures
Poshan	14% higher leaf yield and improvement in leaf quality
Navinya	76% recovery of the root-rot affected plants
Nemahari	5 - 7.28% decrease in root-knot & improvement in leaf yield by ~10%

Resham Krishimelas

No.	Resham Krishimelas (Madakasira; 05-03-2015) (Warangal; 29.03.2015)	Seed Act Programme (Hindupur; 05-05-2015)
1	1400 farmers attended Released the Booklet entitled "Pattu vyavasayam Saanketaka Parignanam" published by RSRS, Anantapuramu for the benefit of farming community.	230 farmers attended

Popularization of Improved Mulberry Varieties : A total of 2486.65 acres were planted with improved mulberry variety with 1284 farmers.

Cluster Promotion Programme: Bivoltine sericulture technologies were disseminated in 13 clusters in Andhra Pradesh and 4 clusters in Telangana states . 46.95 lakh dfls of bivoltine hybrids were reared with an achievement of 111 % against the target of 42.05 lakh dfls and recorded the cocoon yields of 65.59kg/100 dfls. The raw silk production achieved was 440 MT against the target of 360 MT and contributed 11.57 % to the bivoltine raw silk production in the country.

Adharshgram (IVLP): A total of 26,650 dfls of bivoltine hybrids were reared with 151 farmers in two clusters (Rayachoty and Vizianagaram) and the average yield recorded was 53.44 kg/100 dfls, which is an improvement of 8.2% against the benchmark.

Training Programmes under CSS-2109

A total of 1320 farmers were trained in 88 batches in CSS2109 programme during the year 2014-15 and also 108 women and men farmers were trained in ISDS programme

Improved Mulberry Varieties

Unit	Farmers	Acres
RSRS-Salem	900	600
Andhra Pradesh		
REC, Eluru	39	82.00
REC, Kalyandurgam	182	440.00
REC, Madakasira	160	180.00
REC, Rayachoty	85	103.00
REC, V. Kota	128	130.35
REC SU, Atmakur	81	256.80
REC SU, Chebrolu	39	120.00
REC SU, Giddalur	48	131.50
REC SU, Hindupur	40	48.00
REC SU, Palamner	52	48.00
REC SU, Penukonda	40	45.00
Total	894	1584.65
Telangana State		
REC, Vikarabad	137	371.50
REC SU, Metpally	73	99.00
REC SU, Suryapet	180	431.50
Total	390	902.00
Grand total	1284	2486.65

Training Programmes at RSRS-Anantapur & Nested Units				
Unit	CSS 2109		ISDS	
	Prog (No.)	Beneficiaries (No.)	Prog (No.)	Beneficiaries (No.)
Andhra Pradesh State				
RSRS, Anantapur	5	75	8	108
REC, Eluru	5	75		
REC, Kalyandurgam	4	60		
REC, Madakasira	5	75		
REC, Rayachoty	5	75		
REC, V. Kota	6	90		
REC SU, Atmakur	6	90		
REC SU, Bidar	5	75		
REC SU, Chebrolu	5	75		
REC SU, Giddalur	6	90		
REC SU, Hindupur	5	75		
REC SU, Palamner	5	75		
REC SU, Penukonda	7	105		
Telangana State				
Surya Peta	8	120		
Vikarabad	6	90		
Met Palli	5	75		
Total	88	1320	8	108

ADMINISTRATIVE REPORT

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

Regional Sericultural Research Stations (RSRS)

Kodathi, Karnataka

Anantapur, Andhra Pradesh

Chamarajanagara, Karnataka

Salem, Tamil Nadu

Research Extension Centres (REC)

Bidaraguppe [Kar]

Chitradurga [Kar]

Madivala [Kar]

Gobichettipalayam [TN]

Krishnagiri [TN]

Samayanallur [TN]

Srivilliputhur [TN]

Udumalpet [TN]

Palakkad [Ker]

Eluru [AP]

Kalyandurgam [AP]

Madakasira [AP]

Rayachoty [AP]

V. Kota [AP]

Vikarabad [TS]

Amaravathi [MH]

Baramati [MH]

Parbhani [MH]

Hoshangabad [MP]

Sub-units of Research Extension Centre (REC-SU)

Atmakur [Kar]

Bidar [Kar]

Bijapur [Kar]

Jamkhandi [Kar]

Kanakapura [Kar]

Kinkanahalli [Kar]

Koppal [Kar]

Kudligi [Kar]

Maddur [Kar]

Ranebennur [Kar]

Shahapur [Kar]

Shirahatti [Kar]

Shivamogga [Kar]

Tumakuru [Kar]

Avinashi [TN]

Berigai [TN]

Trichy [TN]

Vaniyambadi [TN]

Kalpetta [Ker]

Chebrolu [AP]

Giddalur [AP]

Penukonda [AP]

Metpally [TS]

Suryapet [TS]

Aurangabad [MH]

Jalna [MH]

Osmanabad [MH]

Burhanpur [MP]

Other Units

Cluster Promotion Centre (CPC) : Hindupur

Cluster Development Centre (CDC) : Palamaneru, Y. N. Hoskote

P4 Basic Seed Farm : Hassan

Satellite Silkworm Breeding Station : Coonoor

R&D AND ADMINISTRATIVE PERSONNEL OF CSRTI AND NESTED UNITS

R & D Personnel

CSRTI-Mysuru

Sivaprasad V (Dr.), Director

Ashwath SK (Dr.), Sc.-D

Balavenkatasubbaiah M (Dr.), Sc.-D

Bhagya R (Dr.), Sc.-D

Dasappa (Dr.), Sc.-D

Dayananda (Dr.), Sc.-D

Gandhi Doss S (Dr.), Sc.-C

Gangadhar B (Dr.), Sc.-D

Geetha GS (Dr.), Sc.-C

Girish Naik V (Dr.), Sc.-D

Gunasekhar V (Dr.), Sc.-C

Kariappa (Dr.), Sc.-D

Katiyar RS (Dr.), Sc.-D

Kishor Kumar CM (Dr.), Sc.-D

Kulkarni SB, Sc.-C

Mahima Santhi A (Dr.), Sc.-C

Mal Reddy N (Dr.), Sc.-D

Manthira Moorthy S (Dr.), Sc.-D

Mary Josepha AV (Dr.), Sc.-D

Mukund V. Kirsur, Sc.-D

Munikrishnappa HM, Sc.-C

Munirathnam Reddy M (Dr.), Sc.-D

Nagaraja SB, Sc.-D

Narasimha Nayaka AR (Dr.), Sc.-D

Narendra Kumar JB, Sc.-D

Nishitha Naik V (Dr.), Sc.-D

Parameshwara C, Sc.-C

Pratheesh Kumar PM (Dr.), Sc.-D

Purushotham S (Dr.), Sc.-C

Radhalakshmi YC (Dr.), Sc.-D

Rajashekar K, Sc.-D
 Rekha M, A.D. (Stat)
 Renukeshwarappa JP, Sc.-C
 Sabitha MG, Sc.-D
 Santha PC (Dr.), Sc.-C
 Satish Verma (Dr.), Sc.-E (Engineer)

Sharma SD (Dr.), Sc.-D
 Sharmila KK (Dr.), Sc.-D
 Sibayan Sen (Dr.), Sc.-C
 Somaprakash DS (Dr.), Sc.-D
 Srinivasa BT (Dr.), Sc.-D
 Suma AS, Sc.-D

Thippeswamy T (Dr.), Sc.-D
 Vindhya GS (Dr.), Sc.-D
 Vineet Kumar (Dr.), Sc.-D
 Vinod Kumar Yadav, Sc.-B.
 Vinod Kumar (Dr.), Sc.-D
 Virendra Kumar (Dr.), Sc.-D

Nested Units

Karnataka

Ambika PK (Dr.), Sc.-D
 Hanumantharayappa SK, Sc.-C
 Himantharaj MT (Dr.), Sc.-D
 Ishwar, Sc.-C
 Jayaram H (Dr.), Sc.-D
 Lakshmanan V (Dr.), Sc.-D
 Mahalingappa KC, Sc.-C
 Maheswari M (Dr.), Sc.-D
 Meenal R (Dr.) Sc.-C
 Noble Morrison M (Dr.), Sc.-D
 Pallavi SN (Dr.) Sc.-C
 Philomena KL, Sc.-C
 Raghunath MK (Dr.), Sc.-D
 Rajanna KL (Dr.), Sc.-D
 Raveendra M Mattigatti (Dr.), Sc.-D
 Sanath Kumar YN, Sc.-C
 Shivashankar N, Sc.-C
 Srikanta Swamy K (Dr.), Sc.-D
 Sudhakar P (Dr.), Sc.-C
 Sudhakara Rao P (Dr.), Sc.-C
 Umasha A, Sc.-C
 Vedavyasa K, Sc.-D
 Kalpana GV (Dr.), Sc.-D
 Chandrashekar KB (Dr.), Sc.-D
 Mathur VB (Dr.), Sc.-D

Tamil Nadu

Anbazhagan R, Sc.-C
 Babu CM (Dr.), Sc.-D

Balasaraswathi S (Dr.), SC.-D
 Chandrasekaran K (Dr.), Sc.-D
 Chikkanna (Dr.) Sc.-D
 Dhahira Beevi N (Dr.), Sc.-D
 Gnanakumar Daniel A, Sc.-D
 Gopinath OK, Sc.-C
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 Issac Joseph, Sc.-C
 Mahiba Helen S (Dr.), Sc.-C
 Mary Flora CA, Sc.-D
 Masilamani S (Dr.), Sc.-D
 Mohamed Babu A (Dr.), Sc.-D
 Mohan B, Sc.-D
 Punithavathi G, Sc.-D
 Rajakumar S, Sc.-D
 Ravikumar J (Dr.), Sc.-D
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 Samuthiravelu P, (Dr.), Sc.-D
 Selvaraju NG, Sc.-D
 Sivasubramonian T, Sc.-C
 Thirunavukkarasu T, Sc.-D
 Vijayakumar R, Sc.-C
 Gururaj R, Sc.-D
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Kasi Reddy B (Dr.), Sc.-D
 Mogili T (Dr.), Sc.-D
 Narasimha Murthy B (Dr.), Sc.-D
 Prasad GV (Dr.), Sc.-D
 Raghupathi M (Dr.), Sc.-D
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 Shanthan Babu MA, Sc.-C
 Srinivasa Rao TVS, Sc.-D
 Venkatachalapathy M (Dr.), Sc.-D
 Venkataramana P (Dr.), Sc.-D
 Venkateswara Rao M (Dr.), Sc.-D
 Venugopal A (Dr.), Sc.-D
 Vidyunmala S (Dr.), Sc.-D
 Vijaya Naidu B, Sc.-C
 Chowdary NB (Dr.), Sc.-D

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Srinivasulu Reddy P (Dr.), Sc.-C
 Srinath B (Dr.), Sc.-D
 Sanjeeva Rao BV, Sc.-C

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Karande AJ, Sc.-D
 Ram Prakash, Sc.-D
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 Bagde AP, Sc.-C

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Arasappa R, DD (A&A)
 Ganesan V, DD (C)
 Girijamma, AD (A&A)
 Jayaramulu B (Dr.), DD (OL)

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 Mohan Rao Jadhav, EE
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Pappu BS, AD (Pub)
 Talawar BY, LIO
 Yoganarasimha S, AD (A&A)

Staff position as on 31.03.2015

Category	Sanctioned	Filled	Vacant
Director	1	1	0
Scientific	151	126	25
Technical	193	152	41
Administrative	196	177	19
Support	30	25	5
Total	571	481	90

Budget (Rs. In lakhs)

Budget Head	Grants received	Grants Surrendered	Expenditure incurred during 2014-15
Non-Plan	3,893.93	4.11	3889.82
Plan-Gen-31	710.05		710.05
Plan-Cap-35	178.91	8.19	170.72
Total	4,782.89	12.30	4,770.59

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Details of Review meeting held during the year

No.	Meeting	Date
1	Research Council (RC)	30 th & 31 st July 2014 19 th & 20 th March 2015
2	Research Advisory Committee (RAC)	26 th September 2014
3	Regional Research Advisory Committee (RRAC)	18 th June 2014 at Chamarajanagara 19 th June 2014 at Coonoor 24 th September 2014 at Anantapur

METEOROLOGICAL DATA – CSRTI-MYSURU

Month	Temperature [°C]			Humidity [%]			Rainfall [mm]
	Max.	Min.	Avg.	Max.	Min.	Avg.	
January	31.60	13.80	23.30	77.00	34.00	56.60	
February	32.80	14.40	25.40	86.00	24.00	53.80	1.20
March	36.40	16.00	26.90	85.00	18.00	53.30	21.60
April	36.40	19.80	28.65	85.00	49.00	53.10	6.10
May	35.90	19.00	27.50	90.00	39.00	69.00	207.90
June	34.50	19.00	25.90	95.00	41.00	74.20	94.80
July	31.90	19.50	24.40	96.00	48.00	79.10	193.10
August	31.80	19.50	24.50	95.00	50.00	80.50	71.60
September	31.70	17.40	24.70	95.00	48.00	75.70	208.60
October	31.80	16.90	24.90	96.00	55.00	77.80	87.20
November	30.30	13.40	23.50	93.00	44.00	69.70	12.90
December	30.90	11.90	23.30	89.00	38.00	65.70	22.00
Mean	33.00	16.72	25.25	90.17	40.67	67.38	
Extm. High	36.40	19.80		96.00	55.00		
Extm. Low	30.30	11.90		77.00	18.00		
						Total Rainfall	927.00
						No. of rainy days	53

PUBLICATIONS

International Journals

- Bindroo, B. B. and Moorthy, S. M. (2014) Genetic Divergence, Implication of Diversity and Conservation of Silkworm, *Bombyx mori*. *Int. J. Biodiversity*, doi:10.1155/2014/564850, p:15.
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- Naik, V. G.; Mathi Thumilan; Sarkar, A.; Dandin, S. B.; Pinto, M. V. and Sivaprasad, V. (2014) Development of genetic linkage map of mulberry using molecular markers and identification of QTLs linked to yield and yield contributing traits. *Sericologia*, 54(4):221-228.
- Naseema Begum, N.; Mal Reddy, N.; Manthira Moorthy, S. and Bindroo, B. B. (2014) A new robust bivoltine hybrid (CSR50x CSR52) x (CSR51 x CSR53) of *Bombyx mori* L. for higher egg and cocoon yield. *Sericologia*, 54(1):31-36.
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- Vinayaka Reddy; Lakshminarayana Reddy, B. P.; Shanthan Babu, M. A.; Sujatha, B. and Sankar Naik, S. (2015) Egg laying patterns of the Uzi fly, *Exorista sorbillans* (Wiedemann) on the larvae of the silkworm, *Bombyx mori* L., *Global J. Bio Sci. Biotech.* 4(1):175-180.

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- Yadav, V.K.; Thippeswamy, T. and Bindroo, B.B. (2014) Drip irrigation se water ke conservation ke sath-sath uchit sthan per chemical fertilizer ka upyog. *Resham Kiran (Hindi)*, 4(1): 14-16.
- Chowdary, N. B. and Sivaprasad, V. (2014) Nutrient deficiencies in mulberry. *The Hindu*, 11th Sept. 2014.
- Chowdary, N. B. and Sivaprasad, V. (2014) Management of nematode in mulberry. *The Hindu*, 6th Aug. 2014.
- Justin Kumar, J.; Daniel, A.G.K. and Manochaya, S. (2014) Biotechnological Tools for Silkworm Disease Management. *In: New Prospects on Bioscience Research*, ed. V. Prabakaran, p: 112-125.
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- Mogili, T.; Prasad, G. V.; Sathyanarayana Raju, Ch. and Sivaprasad, V. (2015) Pattupurugula pempakamulo flacherie (natchulu) niyanthrana padhathulu. *Sedya Phalam*, 3(5):19-24 (Telugu).
- Mogili, T.; Prasad, G. V.; Sathyanarayana Raju, Ch. and Sivaprasad, V. (2015) Nuthanapadhathulalo mulberry thota abhivrudhi vidhanam. *Annadata*, 47(3):46-48 (Telugu).
- Mogili, T.; Prasad, G. V. and Sathyanarayana Raju, Ch. (2014) Pattupurugula pempakamulo vachu avasheshala compostingtho Sendriya Eruvu Thayari. *Annadata*, 46(4): 58-60 (Telugu).
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- Prabakaran, V. and Daniel, A. G. K. (2014) Seasonal occurrence of Flacherie, Grasserie and Muscardine diseases in silkworm *Bombyx mori* L. in Salem and Namakkal districts of Tamil Nadu, *In: New Prospects on Bioscience Research*, ed. V. Prabakaran, p:106-111.
- Sakthivel, N. and Chikkanna (2014) Caring for silkworms in summer. *The Hindu*, 24th April 2014, p15.
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- Sathyanarayana Raju, Ch; Prasad, G. V.; Mogili, T.; Kasi Reddy, B.; Reddy, M. P.; Rao, M. V.; Naidu, B. V.; Purushotham, S.; Sivarami Reddy, N.; Vindhya, G. S. and Qadri, S. M. H. (2014) Impact of Cluster promotion programme on bivoltine sericulture in Andhra Pradesh. *Indian Silk*, 4(52 old),10-11: 4-8.
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- Sivaprasad, V. and Sakthivel, N. (2015) Organic farming in mulberry for sustainable silk production, Farmer's Notebook, Science & Technology/Agriculture, The Hindu, 2nd April 2015, p16.
- Sivasubramonian, T. and Daniel, A. G. K. (2014) Uzi fly (in Tamil). In: *Vivasaya malar, Dinamalar*, dated 16.04.2014, p6.
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- Moorthy, S. M.; Chandra Kanth, N. and Nirmal Kumar, S. (2014) Seri-Biodiversity and its conservation. In: *Advances in rural development for sustainable Agriculture (Eds), D. Das Gupta, Agrobiosis (India), Jodhpur, 85-92.*
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CSRTI-Mysuru - EXTENSION UNITS



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Cluster Promotion Centre	01	Satellite Silkworm Breeding Station	01
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