

## CSR&TI, BERHAMPORE, WEST BENGAL

### HIGHLIGHTS OF CONCLUDED RESEARCH PROJECTS WITH REFERENCE TO ACHIEVEMENT OF THE OBJECTIVES, OUTPUT AND UTILITY

Sl. No.	Project Code, Title & period	Objectives	Out-put of the project	Utility of the out-put	Impact on Silk Industry
<b>DURING THE YEAR: 2015-2016</b>					
1	<b>PIB-3424:</b> Development of low temperature stress tolerant mulberry genotypes for sub-tropical plains. (Jan., 09 – Dec., 15)	Development of low temperature stress tolerant mulberry genotype capable of providing higher leaf yield during Agradhayani (Nov.) and Falguni (Feb.) silkworm rearing seasons than the ruling variety, S-1635.	<ul style="list-style-type: none"> <li>Seven new genotypes were identified based on sprouting duration and electrical conductivity.</li> <li>Annual leaf yield/ plant (kg) in seven genotypes were C-45 (1.94 kg), C- 108 (2.12 kg), C-212 (1.97 kg), C-225 (1.87 kg), C-232 (1.85 kg), C-371 (1.74 kg) and C-384 (2.51 kg) while 1.71 kg was in S 1635 (check).</li> </ul>	Further evaluation of selected seven new genotypes i.e., C-29, C-33, C-45, C-108, C-212, C-225 and C-384 under Final Yield Trial and Mulberry Variety Authorization trial.	High yielding and qualitatively superior mulberry variety for increasing mulberry & cocoon production thereby economic development to the farmers.
2	<b>PPS-3452:</b> Terrestrial Carbon sequestration for sustained high productivity of quality mulberry. (July.,11 to June, 15)	To enumerate the enhanced organic carbon stock of the soil due to the induction of altered farming practices in mulberry dim fit to carbon sequestration with comparison to existing one.	Among six farming practices, <b>mulberry growing under moderate tillage with grass cover</b> registered the highest leaf productivity of 38.72 ton ha <sup>-1</sup> year <sup>-1</sup> , the highest CSP of 6.90 ton ha <sup>-1</sup> year <sup>-1</sup> and the highest SOCS of 40.16 mg ha <sup>-1</sup> against the <b>existing farming practice</b> (intensive tillage) leaf productivity 38.16 ton, CSP 6.53 ton and SOCS 35.25 mg ha <sup>-1</sup> , respectively.	A program entitled “ <b>Testing of carbon capturing efficiency of mulberry in different locations</b> ” has already been initiated at RSRSS level.	To increase mulberry leaf productivity, Soil organic carbon stock (SOCS) and Carbon Sequestration Potential (CSP).
3	<b>APS-3497:</b> Studies on the environmental effect on P1 rearing, its' grainage performance followed by commercial rearing of Silkworm <i>Bombyx mori</i> L., during unfavourable seasons of West Bengal. (May, 13 to Apr., 15).	Determination of the effect of environmental factors on P1 seed crop rearing during adverse crop seasons at farmers' level and its subsequent effects on commercial grainage performance and finally on commercial rearing at farmers' level.	Environmental factors such as, temperature and relative humidity influence on silkworm seed crop rearing, reproductive potential and on subsequent commercial grainage performance.	Solving the grainage problems and to overcome the stress during unfavourable crop seasons in West Bengal	Information would be useful in increasing silkworm layings production.
4	<b>AIB-3496:</b> Development of high temperature and high humidity tolerant bivoltine breeds of silkworm ( <i>Bombyx mori</i> L.). (Jul., 12 to Jun., 15)	<ul style="list-style-type: none"> <li>Determination of</li> <li>To develop a method of induction for thermal stress in silkworm.</li> <li>Development of high temperature and high humidity tolerant breed.</li> </ul>	Screening of silkworm breeds under high temperature (35±1°C) and high humidity (85±5%) conditions, 10 breeds were short listed as breeding resource materials based on overall performance with special emphasis on pupation rate. Based on overall performance at farmers' field, M6DPC x (SK6 x SK7) (Multi x Bi. hybrid) in West Bengal and Jharkand states and bivoltine hybrid, B.Con.1 x B.Con.4 in West Bengal, Jharkand and North Eastern states was recommended to rear during favourable seasons (Agradhayani, Falguni and Baishaki).	Selected 10 breeds with higher pupation at high temperature and high humidity conditions, will be utilised for further breeding work.	Hardy Multi x bivoltine and bivoltine x bivoltine hybrids for increasing cocoon and silk production.
5	<b>AIB-3531:</b> Authorization trials of silkworm hybrids in Eastern and North	•To evaluate the newly developed, Multi x Bi and Bi x	• Multi x Bi hybrid [M6DPC x (SK6 x SK7)] performed cocoon yield 50.4 kg against	New hybrids will be authorized for	Region-wise selection of hardy Multi x bivoltine and bivoltine x bivoltine hybrids

	Eastern India. (Aug., 14 to July, 15)	<p>Bi hybrids at the farmers level in Eastern &amp; North Eastern Zone</p> <ul style="list-style-type: none"> <li>• To popularize the newly developed hybrids at the farmers level in Eastern &amp; North Eastern Zone</li> <li>• To analyze the data of the tested hybrids in Eastern &amp; North Eastern Zone.</li> <li>• To identify the suitable hybrids for the Eastern &amp; North Eastern Zone.</li> <li>• Recommendation of the hybrids for the Eastern and North Eastern zone for commercial exploitation.</li> </ul>	<p>46.9 kg/ 100 dfls of Nistari x (SK6 x SK7).</p> <ul style="list-style-type: none"> <li>• Bivoltine foundation cross B.Con.1 x B.Con.4 performed cocoon yield 51.6kg against 47.6 kg/100 dfls of (SK6 x SK7) during Agrahayani/Autumn, Falguni/ Spring and Biashaki crop seasons.</li> </ul>	commercialization in Eastern and North Eastern India.	for increasing cocoon and silk production.
6	<b>PRE-3508:</b> Studies on standardization of mass multiplication and field efficacy of <i>Scymnus pallidicollis</i> (Mulsant) for eco-friendly management of Tukra. (Apr., 14 to Mar., 16)	<ul style="list-style-type: none"> <li>• To study the intrinsic rate of increase of the native predator in ambient conditions (as suggested by referees while evaluating the project).</li> <li>• To standardize the mass multiplication technique of the native predator.</li> <li>• To determine the optimum number of native predators that are required to be released per unit area.</li> </ul>	<ul style="list-style-type: none"> <li>• Life cycle of the predator <i>Scymnus pallidicollis</i> (Mulsant) under ambient conditions is 23- 25 days.</li> <li>• Recorded Multiplication rate of the pest (<i>M. hirsutus</i>) and its predator (<i>Scymnus pallidicollis</i>) was under laboratory conditions.</li> <li>• Released predators at field level</li> </ul>	Mass multiplication of predator, <i>Scymnus pallidicollis</i> (Mulsant) and evaluate predatory efficiency of <i>Scymnus pallidicollis</i> (Mulsant) will be popularized against mealy bug ( <i>M. hirsutus</i> ) for effective control of mealy bug.	To suppress mulberry pests and saving of crop loss.
7.	<b>PRE-3511:</b> Studies on predatory efficacy of coccinellid predator, <i>Scymnus posticalis</i> Sicard for management of white fly on mulberry. (Apr., 14 to Mar., 16)	<ul style="list-style-type: none"> <li>• To evolve standardization of mass multiplication technique of the predator, <i>scymnus posticalis</i> sicard.</li> <li>• To evaluate predatory efficiency of <i>scymnus posticalis</i> sicard against whitefly, <i>dialeuropora decempuncta</i> on mulberry</li> </ul>	<ul style="list-style-type: none"> <li>• Mass culture of mealy bug was done on potato sprouts and pumpkin. After release of 100, 200 &amp; 300 mealy bug egg masses on pumpkins within a period of 30 days., it was multiplied 8565, 12438 &amp; 15647 in numbers</li> <li>• Life cycle of the predator completed within 23-31 days.</li> <li>• Biological attributes of the predator on mealy bug revealed prolong life span and it could not be multiplied in large scale.</li> </ul>	Standardization of mass multiplication technique for the predator, <i>scymnus posticalis</i> sicard and its predatory efficiency against whitefly, <i>Dialeuropora decempuncta</i> on mulberry will be helpful in IPM system.	To suppress mulberry pests and saving of crop loss.
<b>DURING THE YEAR: 2016-2017</b>					
1.	<b>PIB-3479:</b> Development of high yielding mulberry varieties using physiological growth parameters as markers for	To develop mulberry varieties with superior quality and with 10% higher leaf yield over	1.Total of 1024 progenies, derived from six female and seven male parents were evaluated for growth traits and leaf yield in five crop seasons during 2015-16.	1.Thorough evaluation of identified promising (~24) lines for further yield trials (PYT)	Utilizing the leads of the project a new project Code No. <b>PIB 3610</b> "Preliminary

	selection. (Oct., 2012 to Sept., 2016).	existing ruling variety.	<p>2. The progenies recorded significant variation for physiological growth traits viz., total Chlorophyll content (11.1-30.4 <math>\mu\text{g cm}^{-2}</math>), Leaf area index (5.3-13.2), Leaf weight ratio (0.4-0.56), Leaf area duration (2.9-7.3 <math>\text{m}^2\text{day}^{-1}</math>), absolute growth rate (18.15-33.91 <math>\text{g day}^{-1}</math>) and specific area (185.3- 372.13 <math>\text{cm}^2\text{g}^{-1}</math>).</p> <p>3. Based on annual leaf yield and physiological traits, <b>twenty four superior progenies</b> were shortlisted with leaf yield range from 2.104 to 2.561 kg/plant compared to check S-1635 (1.620 kg/plant).</p> <p>4. Moreover, propagation traits viz., cutting survival (%), shoot and root lengths were observed to be at par/better than check S-1635.</p>	before field utilization.	evaluation of newly evolved mulberry genotypes for mulberry improve-ment” already been initiated.
2.	<b>AICEM-III:</b> All India Coordinated Experimental Trail for Mulberry (AICEM)-Phase III, (A prog. of C.O., Bangalore) (Aug., 2011 to Dec., 2016).	To identify and authorize suitable mulberry variety for commercial use in different agro-climatic mulberry cultivation zone of India.	<p>1. Mulberry genotype <b>C-2038</b> exhibited highest average annual leaf yield production (53.8 t/ha / yr in irrigated and 17.3 - 21.3 t/ha/yr in rainfed) and excelled the check (S-1635) by 21% and 23% in irrigated and rainfed condition of Eastern and North Eastern regions.</p> <p>2. In hilly region of Kalimpong, <b>Tr-23</b> appeared best performing genotype and showed 10-12 t/ha/yr i.e., ~ 42% higher leaf yield over the check S-146.</p>	The promising genotype will be popularized through extension programme.	Will enhance the production of mulberry leaves per unit area, farmers will be encouraged with the gain through this technology.
3.	<b>PIB-3515:</b> Evaluation of new developed triploid mulberry varieties for productivity and quality. (Jun., 2014 to Mar., 2017).	Evaluation of newly developed triploid mulberry varieties under irrigated condition for better productivity and quality.	Identified <b>7 genotypes</b> with significantly higher leaf yield 370 -445 g/crop (21.9 to 46.8 %) over the ruling variety, S-1635. The selected genotypes were also found to be superior in their biochemical parameters and at par with check for physiological traits like moisture content and moisture retention capacity.	Identified genotypes with leaf yield may be evaluated thoroughly under FYT for commercial exploitation.	Identified promising genotypes need to be evaluated in large scale to identify one best one for commercial exploitation.
4	<b>APS-3539:</b> Characterization of mulberry growing soils for nutrient management in selected Seri-villages of Golaghat district of Assam. (April, 2015 to March, 2017) (Collaborative with NBSS&LUP, ICAR, Jorhat)	<ol style="list-style-type: none"> <li>To characterize and classify the mulberry growing soils.</li> <li>To prepare soil test based fertilizer recommendation chart for the mulberry growing soils.</li> <li>To popularize the soil test based fertilizer application among the farmers as per the fertility rating chart developed.</li> </ol>	<ol style="list-style-type: none"> <li>Recommended 0.1 % foliar sprays of boron along with recommended dose of fertilizer (RDF) for micronutrient Boron deficit mulberry growing soil.</li> <li>Recommended NPK (150:50:50) per ha for medium fertility soil.</li> <li>Recommended 25 % extra of RDF for low fertile soil and 15% less of RDF for high fertile soil.</li> </ol>	<ol style="list-style-type: none"> <li>Selection of 20 farmers (5 in each district), Jorhat, Golaghat, Dibrugarh and Derang.</li> <li>Demonstration and popularization of sericulture farmers.</li> </ol>	Soil fertility status will be sustained. Besides, it will reflect in the production of mulberry leaves per unit area.
5	<b>PPS-3504:</b> Study on root rot disease of mulberry in the Gangetic plains of West Bengal and development of its control measures. (April, 2014 to Mar., 2017)	<ol style="list-style-type: none"> <li>Survey and collection of root rot disease from the Gangetic plains of West Bengal.</li> <li>Isolation and identification of the organism causing root rot disease of mulberry.</li> <li>Recording of severity of root rot disease of mulberry in different locations of the Gangetic plains of West</li> </ol>	Survey revealed that root rot was predominant in the Gangetic plains of West Bengal. Root rot pathogen was identified as <i>Fusarium solani</i> from IARI, New Delhi and NFCCI, Pune. 0.20% SAAF (Carbendazim 12% + Mancozeb, 63%) application was found effective with 94.4% growth inhibition of <i>F.solani</i> under <i>in vitro</i> condition. Application of biocontrol agent <i>Trichoderma viride</i> was found effective with 66.22% growth inhibition of <i>F.solani</i> . Management approach was popularized among farmers using pamphlets.	Application of 0.20% SAAF (Carbendazim 12% + Mancozeb, 63%) for the management of root rot in mulberry.	Timely management will help to reduce the damage caused by root rot disease; farmers will be benefitted through this technology.

		Bengal. 6. Isolation of fungicide as control measure (In vitro) for plant root protection method including bio control agents and chemical management.			
6	<b>CSS-2107:</b> Forewarning of mulberry diseases of Eastern and North Eastern India. (April, 2012 to Mar., 2017)	<ol style="list-style-type: none"> <li>To collect disease incidence and meteorological data from Eastern and NE India.</li> <li>Recommendation of forewarning system package in different locations.</li> <li>Development of long term and broad spectrum data base on disease severity.</li> <li>Fine tuning of disease forecasting models at the end of XII th plan.</li> <li>Fine tuning of existing disease calendar at the end of XII th plan.</li> </ol>	<p>Meteorological data and disease severity from different centers were collected and compiled.</p> <p>Forewarning calendar and spray schedule developed for PMLD, BLS, MLS, PLS and LR.</p> <p>Developed disease forecasting model for BLS (Bacterial leaf spot disease), PLS (<i>Pseudocercospora</i> leaf spot), PMLD (Powdery mildew), LR (Leaf rust) and MLS (<i>Myrothecium</i> leaf spot) in Murshidabad district, MLS for Malda district, LR and PMLD for Kalimpong, PMLD for Aizawl, and Agartala, LR for Dimapur, PMLD for Imphal, LR for Koraput and Rangpoo.</p>	With changing climate disease incidence and severity is changing which needs to be monitored continuously.	Programme need to be continued to generate data on the changes in disease occurrence due to climate change
<b>DURING THE YEAR: 2017-2018</b>					
1	<b>PPE-3517:</b> Population Interaction of pest and natural enemies in mulberry ecosystem. (Aug., 2014 to July, 2017) (Collaborative with NBAIR, Bangalore)	To study the population interactions of host plant, major mulberry pests and their natural enemies and correlation with abiotic factors. Studies on the biological attributes of the parasitoids.	The life stages of the pests were collected from the field and screened in the laboratory for the emergence of parasitoids & predators.	<ol style="list-style-type: none"> <li>Studied the effect of the major mulberry pests and their control by natural enemy complex.</li> <li>Made a list of alternate hosts for pests and their natural enemies.</li> <li>Migration pattern of natural enemy complex will be explored</li> </ol>	Will explore the possibility to inhibit the growth of pest and increase the population of natural enemies.