DETAILS OF COLLABORATIVE RESEARCH PROJECTS UNDERTAKEN BY VARIOUS CSB R&D UNITS DURING THE LAST FIVE YEARS (2014-2019)

#	Project Title & Code	Period and Budget (Rs. Lakh)	Collaborating Institute	Outcome and impact
I. Collaboration with International Research Institutes				
1.	Studies on the genetic characterization, transmission and tissue distribution of Iflavirus infecting the Indian tropical tasar silkworm, *Antheraea mylitta*- **ARP 08001 CI**	2018-2020 (Rs.83.00)	Swedish Research Council and SBRL Kodathi, CSB Bengaluru	Characterization of ifla virus infecting the tasar silkworm *Antheraea mylitta* and development of early detection and controlling measures.
2.	Improvement of silkworm breeding in India and Bulgaria - **AIB-3537** **(**Indo-Bulgarian Collaborative research project)	2015-2020 (Rs.12.25)	Sericulture Experiment Station, Vratza, Bulgaria and CSR&TI, CSB, Mysore	25 Oval FC and 15 Dumbbell FCs were developed utilising silkworm genetic resources from Bulgaria and a new bivoltine double hybrid BFC1 x BFC 10 was developed with 24.3 SR%, 1120 M filament length and 5.5 renditta, which is under field trial.
3.	Development of Sericin Based Nano Finish for Textile Materials - **CFC 7072**	2015 – 2018 (Rs.12.62)	Deakin University, Australia and CSTRI, CSB, Bangalore	Process developed for sericin application on polyester, cotton, PC blend, wool and silk fabric with improved durability and with eco-friendly chemicals, which can be utilized by fabric processors. The treated fabric offers better wicking, moisture regain, smoothness and dye ability.
4.	Studies on Photo Degradation of Silk Fabrics - **CFC 7073**	2015- 2018 (Rs.32.62)	Deakin University, Australia and CSTRI, CSB, Bangalore	The project comes out with optimized yarn and fabric structural parameters and finishing treatment to improve the photo degradation property of silk fabric.
5.	Studies on electrospun silk fibroin nanocomposite fibres for biomaterial	2015- 2018 (Rs.27.62)	Deakin University, Australia and CSTRI, CSB,	Standardized the methods for developing electro spun silk fibroin nanocomposite fibers for utilizing in

	applications.**CYF-7074**		Bangalore	biomaterial applications.
6.	Molecular characterization of Indian isolate(s) of Densovirus (DNV) and viral resistance gene in the host, silkworm *Bombyx mori L.*- **ARP-3513**	2014-2016 (Rs.6.40)	University of Tokyo, University of Ryukuys and NIAS, Japan & SBRL Kodathi, CSB Bengaluru	Characterized DNV genome and identified densovirus resistance gene (*nsd2*) gene responsible for infection and multiplication in the host. This gene is being used for screening the germplasm towards developing disease resistant silkworm breeds.
II. Collaboration with National Research Institutes/Organization				
7.	Engineering photosynthesis in Mulberry for resilience to climate change: A C4 approach - **PIC -3620**	2017-2021 (Rs.69.96)	University of Hyderabad and CSR&TI, CSB Mysuru.	C4 mulberry plants will be developed through genetic engineering to increase leaf yield through enhanced photosynthetic efficiency.
8.	Assessment of SNP variation in silkworm (*Bombyx mori* L.) by genotyping by sequencing and genome-wide association mapping of important commercial traits – DBT Funded- **AIT 3628**	2017-2020 (Rs.67.42)	RV college of Engineering, Bangalore and CSR&TI, CSB Mysuru	Association mapping will be developed in silkworm to speed up the breeding process through marker assisted selection.
9.	Identification of most active cocoonase of sericigenous insects through molecular characterization - **AIT-4728**	2018-2021 (Rs.119.53)	CTRTI Ranchi, IISER Pune, BIT Miersa	Molecular characterization of cocoonase will be done to produce it in large scale for commercial utilization.
10.	Biodiversity assessment of wild silkmoths and rearing potentialities of muga (*Antheraea assamensis Helfer*) and eri silkworm (*Samia ricini Donovan)* for sustainable development in Nagaland – **APR-5890**	2017-2020 (Rs.54.40)	Nagaland University, Mokokchung, Nagaland and CMERTI, CSB Lahdoigarh.	Wild cocoons (84 nos.) were collected and are under evaluation to estimate the genetic diversity. Rearing of Eri silkworm by feeding with different types of host plants, viz. castor, tapioca, kessuru and payam in different stages are being done to find their suitability.
11.	Development of Decision Support System for early warning of selected	2016-2019 (Rs.14.55)	NESAC, Shillong and CMERTI, CSB Lahdoigarh,	Instruments were installed on Nangpoh to record the weather parameters on daily basis. Training was

	muga silkworm diseases & pests with geospatial technique. [In collaboration with NESAC]- CSB Funding – **ARP - 5874**		Assam	imparted to local farmers on Handling the instruments for recording weather parameters periodically.
12.	Standardization and Popularization of Treated Bamboo Products in Ericulture – **APR-5888**	2017-2018 (Rs.29.82)	Rain Forest Research Institute (RFRI), ICFRE, Jorhat; NABARD, Jorhat and CMERTI, CSB, lahdoigarh	Eri Collapsible Mountages were prepared by trained Entrepreneurs in different districts of N.E. Region
13.	Whole Genome Sequencing and functional genomics of Golden Silk Moth *Antheraea assamensis* - **AIT 5872**	2015-2019 (Rs.69.00)	IISc, Bangalore, IIT, Guwahati, CDFD, Hyderabad, CMERTI, Ladoigarh	Whole genome of Muga silkworm has been sequenced and the genome size was found to be 500 Mb.
14.	Development of value added product from spent pupae of mulberry silkworm – **AIP - 3568**	2016-2019 (Rs. 58.31)	NIANP, ICAR, Bangalore and CSR&TI, CSB Mysuru	α-Linolenic acid has been extracted from silkworm pupae for its pharmaceutical use and also processed the spent pupae as animal feed for value addition.
15.	Evolution of superior mulberry varieties suitable for temperate region through somatic hybridization – **PIB - 3571**	2016-2019 (Rs.39.90)	University of Kashmir and CSR&TI, CSB, Pampore	43 somatic hybrids have been developed from PPR1 x CW, PPR1 x Ichinose & PPR1 x PPR1 hybrid combinations. The plants are under acclimatization to transfer to the field.
16.	Yield gap analysis of cocoon productivity under conditions of North West India – **MOE-3574**	2016-2018 (Rs. 8.35)	SKUAST-Jammu and CSR&TI, CSB, Pampore	The factors responsible for the yield gap were identified and the remedial measures were developed and communicated to the stake holders for narrowing the cocoon yield gap between Research yield and actual yield suited to local conditions of North West India.
17.	Application of growing degree days as a model driver for developing mulberry yield weather model –	2016-2018 (Rs. 2.85)	NESAC, Shillong & CSR&TI, CSB Berhampore	Prepared a model for estimating the mulberry growth and leaf yield based on the temperature and weather conditions.

	PPF-3585			The model is being tested in the field for validation and popularization.
18.	Multi-locational field trials of transgenic *BmNPV* resistant silkworm strains to establish their efficacy and generate data for their regulatory approval.	2015-2018 (Rs. 39.47)	CDFD, Hyderabad, APSSRDI Hindupur and CSB Bangalore.	Transgenic silkworms developed through RNAi having resistance to NPV have been tested in different locations to evaluate the efficacy of the transgene and also to assess the performance on economic parameters. The data has been presented to the RCGM for further approval to test them in the field conditions.
19.	Development of transgenic silkworm for the over expression of disease resistant genes for enhanced immunity-**AIT - 3540**	2015-2018 (Rs.40.00)	Indian Institute of Science (IISc), Bangalore and SBRL Kodathi, CSB, Bangalore	Developed transgenic silkworm Over-expressing Relish and Drosomycin genes. Bioassay showed Relish over-expression resulted in enhanced resistance to microspordians and NPV. Drosomycin expression resulted in resistance to microsporidan.
20.	Development of fibroin fusion silk with antioxidant and antibacterial properties **AIT - 3538**	2015-2019 (Rs. 58.99)	Indian Institute of Science (IISc), Bangalore and SBRL Kodathi, CSB, Bangalore	Developed fusion silk fibers with antioxidant and antibacterial properties for biomedical applications. The fusion protein is being tested in animal model for evaluating their efficacy.
21.	Development of diversified silk knit wear products / garments using international quality Indian silk. **CFW - 7080**	2016-2017 (Rs.14.15)	NIFT-TEA Tirupur and CSTRI, CSB , Bangalore	Created new silk knit product lines for value addition with new market avenues.
22.	Identification, characterization, synthesis and field evaluation of sex pheromone of the mulberry leaf roller *Diaphania pulverulentalis*- **PRE-3546**	2016-2017 (Rs.6.00)	NBAIR, ICAR, Bangalore and CSR&TI, CSB Mysuru	Sex pheromone based trap has been developed to control mulberry leaf roller. The same is being evaluated in the field for validation and popularization.

23.	Assessment, development and management of area under mulberry in major sericulture districts of West Bengal using geospatial techniques **PPF- 3532**	2015-2017 (Rs.20.00)	NESAC, Shillong & CSR&TI, CSB Berhampore	Acreage estimation of mulberry has been made utilizing Resourcesat-2 LISS III LISS IV, satellite data adopting supervised classification approach in all the selected four districts and communicated to DOS for adoption.
24.	Population interaction of pest and natural enemies in mulberry ecosystem. **PPE-3517**	2014-2017 (Rs.17.18)	NBAIR, ICAR, Bangalore and CSR&TI, CSB Berhampore	Studied the seasonal incidence of major pests and developed biological control measures.
25.	Characterization of mulberry growing soil for nutrient management in selected seri villages of Golaghat district of Assam –**PPS-3539**	2015-2017 (Rs.8.00)	NBSS & LUP, Jorhat and CSR&TI, CSB, Berhampore	Studied the nutrient status of the soils in mulberry growing regions and suggested soil test based fertilizer application schedules.
26.	Isolation and Characterization of Anti Fungal Peptides from Muga Silkworm *Antheraea assamensis Helfer* - **ARP 5868**	2014-2017 (Rs.32.58)	NEIST, Jorhat; IIT, Kharagpur and CMERTI, CSB, Lahdoigarh, Assam	Antifungal peptides have been isolated and characterized for its utilization in controlling the diseases.
27.	Development of RNA interference (RNAi) based nuclear polyhedrosis virus resistance transgenic silk moth. **AIT 3468**	2011-2017 (Rs.27.05)	CDFD, Hyderabad, APSSRDI, Hindupur and SBRL, CSB, Kodathi	The transgene responsible for RNA-interference to provide NPV resistance has been transferred to productive bivoltine silkworm breed CSR4 and CSR27 through conventional method for developing disease resistant hybrids. Approval from RCGM is awaited for field trials.
28.	Development of erisilk based nonwoven fabrics as facial masks for cosmetic applications **CYF -7067**	2015- 2016 (Rs.7.50)	L'Oreal, Mumbai and CSTRI, CSB Bangalore.	Methodology has been developed to manufacture eri silk nonwoven fabric of desired quality for facial mask applications and evaluated the physical and mechanical properties.
29.	Studies on silk carpets: Influence of structure on carpet properties – **CYF -7070**	2015- 2016 (Rs.7.80)	IICT, Bhadhoiand CSTRI, CSB Bangalore	Evaluated the tuft withdrawal force/ breaking strength of tuft, compression, abrasive

				wear, static/dynamic loading, flammability, colour fastness characteristics of carpets and to evaluate influence of carpet structure on its properties.
30.	Characterisation of sericin for cosmetic applications – **CFC 7064**	2014-2016 (Rs.24.80)	Unilever, Bangalore and CSTRI, CSB Bangalore	Prepared Sericin in pure form by degumming silk yarn at high temperature and hydrolysed it to below 20 kDa molecular weight fractions and characterised for its suitability for cosmetic applications.
31.	Studies on pest status and eco-friendly management of thrips (*Pseudodendrothrips mori*, *Thysanoptera: Thripidae*) on mulberry in Tamilnadu and Karnataka. **PRE- 3512**	2014-2016 (Rs.7.14)	NBAIR, ICAR Bangalore and CSR&TI, CSB Mysuru	Developed an eco-friendly pest management system for mulberry.
32.	Cryopreservation of Tasar silkworm, *Antheraea mylitta* semen and its artificial insemination – **AIE 3555**	Feb,16 – Jan,19 (Rs.58.50)	Collaborative project with CSGRC, Hosur- transferred to CTR&TI, Ranchi.	Developed a technique for semen collection from Tasar silkworm, *Antheraea mylitta* and the cryopreservation of the collected semen is under progress.
33.	Transkingdom RNA interference (tkRNAi) approach for resistance against BmNPV infection in silkworm *Bombyx mori*. **AIT 3583**	Sept., 2016 – Aug, 2019 (Rs.29.13)	SBRL, Kodathi	Two genes ie-1 and lef-1 were cloned in L4440 and dsRNA efficiently expressed in *E.coli* expression system and fed to *Bm*NPV infected silkworms. The results showed decrease in viral multiplication and less number of viral copy in dsRNA fed silkworms. The expression level of viral genes was significantly low in dsRNA fed silkworms**.**