Central Sericultural Research and Training Institute, Mysuru, Karnataka

HIGHLIGHTS OF CONCLUDED RESEARCH PROJECTS (2012-2018)

List of concluded projects during 2012-13 (Projects – 04)

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	Project Cost	Objectives achieved	Outcome of the Research Project	Utilization of outcome	Remarks
1	PPA 3420 (Agronomy)	Studies on the comparative yield potentiality of promising mulberry varieties under different sources of organic and in organic nutrients.	To study the yield potentiality and varietal response to organic inputs / inorganic nutrients. To study the physical, chemical and biological properties of the soil in different treatments To work out the economic feasibility of Organic farming and its suitability	Srikantaswamy, K., Dasappa, M.K.P.Urs., B. Nagaraju	Jan. 2008-Dec. 2012	Rs.8 lakhs	Fully achieved	The present investigation indicated that the high yielding varieties V1, RC1 and S13 exhibited favourable response to organic practice, recording higher leaf yield when compared to the recommended practice T_0 (combined application of chemical and inorganic inputs). Based on the advantages observed in the present study, an organic package has been developed which comprised of 10 MT FYM + 15 MT of well decomposed seri-compost + 5 MT of vermicompost + 23 kg of bio fertilizer + 10 MT insitu composting.	This can be field tested and validated as an agronomical organic package with either V1 or other improved varieties like RC-1 and S-13 for sustainable crop production.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
2	AIB 3437 (MBL)	Studies on hybrid evaluation and identification of new polyvoltine X bivoltine	To identify polyvoltine and bivoltine breeds and F1 hybrids of Polyvoltine x bivoltine through hybrid evaluation.	P.Rama Mohana Rao, V. Premalatha, P.G. Joge, Dayananda	Jan. 2010 - Dec. 2012	**Rs. 3.9 lakhs**	Fully achieved	Two polyvoltine x bivoltine hybrids *viz*., NDV6 x CSR51 and L14 x CSR50 which were	The newly identified hybrids can be further tested to increase the	

		hybrids of the silkworm *Bombyx mori* L.	□ To study the performance of identified polyvoltine x bivoltine hybrids under large scale at in-house level. □ To study the performance of identified polyvoltine x bivoltine hybrids in different agro-climatic regions under On Station Trials at RSRSs of southern region.					significantly superior over the existing cross breed PM x CSR2 with respect of quantitative and qualitative traits.	cocoon productivity at farmers level. A new project proposal for the Pre-authorisation field trials has been sent to CSB for approval.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
3	MOE 3461 (SEEM)	Assessment of women participation and time spent on different sericulture activities in three southern states.	To understand the socio-economic and demographic status To find out participation, time spent and drudgery involved in sericulture activities To assess the constraints encountered and accessed to resources while participating in the sericultural activities	G. S. Geetha	Oct. 2011 - Jan. 2013	Rs. 0.50 lakhs	Fully achieved	The study conducted in three southern states indicates that majority of the sericulture women farmers were in the middle-aged category (35-45 yrs) with a sericulture experience of about 10 years and having family size of 3-5 members. Majority of the farmers were married (100%) with no schooling (36%) and belonging to backward class (72%). The participation of women farmers in mulberry cultivation (on farm activities) is 48.38% and 74.31% in silkworm rearing. The main on farm activities carried out by women were collection of pruned sticks, shoot harvest, weeding fertilizer application manure application and pruning. Besides this the important silkworm rearing activities attended by women are feeding of worms, cleaning of rearing house, cleaning of rearing equipments, harvesting of cocoons, deflossing of cocoons, picking of ripened worms, mounting of worms and disposal	The findings of the study enable the realistic mapping of labour intensive and recurring activities mostly done by women. The findings of the survey facilitate us for a realistic planning for employment, skill training and formulation of policies on development	

								of rearing waste. The study reveals that women farmers spend around 4.18 hours on an average per day particularly for sericulture activities compared to her counterpart (men) around 3.34 hours per day. The main constrains expresses by women farmers were - Lack of family labor, inadequate access to credit, lack of technological know-how, land located at distances, lack of sericulture inputs, lack of rearing house and non-profitable activity.	and welfare and gender perspective of sericulture women.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	Outcome of the Research Project	**Utilization of outcome**	**Rem arks**
4	AIG 3438 (BBL)	Evaluation and on-farm trials of single and double hybrids with high amylase activity and temperature tolerance	To test the efficacy of amylase activity as an additional parameter for selection of hybrids To assess thermo-tolerance of newly evolved single hybrids and double hybrids developed by amylase selection and identification of thermo-tolerance hybrids	S.K. Ashwath, K.K. Sharmila, V.N. Sudha	Aug 2008 - Jun. 2012	Rs. 3.50 Lakhs	Fully achieved	With the goal of identifying promising hybrids with high amylase activity as well as thermo-tolerance, amylase activity was assayed in 12 single hybrids, 10 each of oval and dumb-bell foundation crosses (FCs) and 42 double hybrids. Further, pupation rate of these batches were also recorded under high temperature (36°C) & high humidity (85% R.H.) from the 3rd day of 5th instar for 6 hours daily till spinning. The data was collected under three trials. Among the single hybrids, highest amylase activity and highest pupation rate under temperature stress was recorded in 2C x 4S. Among the double hybrids, highest amylase activity and highest survival under	The single hybrid 2C x 4S and double hybrid G11 x G19 will be subjected for large scale pre-authorisation trials and based on the results these hybrids will be proposed for Race authorization.	

								high temperature was recorded in G11 x G19 and both have been short-listed for OST at RSRS. The On Station trials of the single hybrid, 2C x 4S and double hybrid, G11 x G19 carried out at RSRS Anathapur, Chamarajanagar, Kodathi and Salem under six rearings, have shown higher survival than the controls at Chamarajanagar and Ananthapur. Further, field-testing of 2870 dfls both the hybrids through REC, Madivala with 11 farmers have shown yields of 67-68 kg/100 dfls. The OST results at Ananthapur and Chamarajanagar as well as limited field trials have shown the possibility of commercial exploitation of these hybrids under sub-optimal conditions where bivoltine hybrids can be popularised on large scale in place of crossbreeds.		

List of concluded projects during 2013-14 (Projects – 06)

Sl. No.	Project Code	Project Title	Objectives	Investigators	**Project period**	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Rem arks**
5	PIB 3268 (MBG)	Development of Superior Mulberry Varieties Suitable For Moisture Stress Environments (Phase-II).	To exploit diverse genetic resources through purposive breeding to develop superior mulberry varieties for soil moisture stress	M.K.P. Urs , Rajasekhar. K., M. Rekha, B. Mallikarjuna, M. Pitchi Reddy	Apr. 2002 - Mar. 2014	Rs.1.5lakhs	Fully achieved	32 hybrids from a population of 3080, involving 35 crosses were evaluated under Primary Yield Evaluation experiment both under moisture stress and non-stress environments at three locations [Mysore, Anantapur and Chamarajanagara] and 5 genotypes were short-listed.	The selected hybrids are being multiplied at the respective stations for further validation through multi-locational	

			environments.					Final Yield Evaluation of five short listed genotypes and one check S-13, was conducted at three centers. Identified 3 hybrids, MSG2, MSG7 and MSG26 out-yielding the check [S13] by 20.40, 17.23 and 35.55% under rainfed conditions at CSRTI, Mysore; RSRS, Chamarajanagara and RSRS, Anantapur, respectively.	trials under moisture stress conditions.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Rem arks**
6	PRE 3467 (PML)	Evaluation of available management strategies for Giant African Snail (*Achanta fulica*) in mulberry ecosystem.	To monitor snail population in hot spot area and estimation of mulberry leaf yield loss. To Identify suitable mechanical and chemical methods for the management of giant African Snail in mulberry crop system. Determine the safe period of the effective chemicals (to silkworms) used in management of giant African Snail.	B. T. Sreenivas, J. B. Narendrakumar, P.M. Prateesh Kumar, M. R. Subrahmanyam	Oct. 2011 - Mar. 2014	1.5 Lakhs	Fully achieved	Field survey conducted in H.D. Kote area revealed an average leaf yield loss of 7.49% (range 4.35 to 11.06%). Experimental results on various control measures are as follows: Mechanical control: Papaya stem waste was found effective in trapping the snails followed by mulberry waste & cabbage waste. Chemical control: Two kg of 2.5% Metaldehyde pellets are required to be spread in one acre of mulberry garden in alternate rows (@2 to 3 pellets/spot) during evening hours for effective snail management. 2.5% Metaldehyde pellets can also be placed in hiding places of snails, compost pits, dumping yards for suppression of snail population.	During rainy season regular monitoring of snail incidence, especially in hot spot areas of Kanakapura, Ramanagara, & H.D.Kote taluks in Karnakata and Gobichettypalyam, Kuttipalyam, Sathyamanagalam in Tamil Nadu will be carried out. Besides, farmers will be educated for adoption of the package for snail management in mulberry through awareness programmes.	

								2.5% Metaldehyde was found to be safe to silkworms both by direct contact as well as by feeding mulberry leaves from the mulberry plants treated with the molluscide.		

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Rem Arks**
7	AIP 3478 (S.W. Physio)	Studies on mulberry leaf nutrition on intermediary metabolism of silkworm *B. mori* L	Correlation of mulberry leaf nutrition on intermediary metabolism and economic parameters of hybrids of silkworm Bombyx mori L	M. Muniratnam Reddy, M. Ramesh	Apr. 2012 - Oct. 2015	Rs.4 Lakhs	Fully achieved	The cocoon weight, shell weight and shell percent were significantly high in CSR2xCSR4 hybrids fed on V1 mulberry compared to S36. Total protein and free amino acid values ranged from 26.30 to 145.48 and 28.26 – 112.46mg/g or ml respectively. The range of total lipid values and free fatty acid values were observed to be 32.84 -56.62 and 29.22 - 42.26 mg/g or ml respectively. The total carbohydrates and glycogen were found vary from 26.86 -78.52 and 12.46 -19.64ug/mg or ml respectively. The maximum amino acid levels with concomitant increase in the levels of total and soluble proteins in silk gland, haemolymph and mid gut was found in CSR2 breeds and hybrids fed on V1 mulberry leaves compared to S36. Correlation coefficient of leaf nutrients with cocoon production in all silkworm breeds and hybrids were studied. Crude protein content of leaf showed significant positive correlation with cocoon production. Like wise carbohydrates had significant positive correlation with cocoon production. Other parameters showed negative correlation with cocoon production. Bivoltine breeds reared on V1 variety showed maximum carbohydrates and glycogen in the silk gland, haemolymph and mid gut tissues	Mulberry leaf quality has a direct bearing on cocoon production and productivity will be an essential step for increasing silkworm cocoon production. Possible role of enzymes like amylase, succinate dehydrogenase and alkaline protease will help in the silkworm breeding programme with improved economic traits and disease resistance	

								when compared to S36. The results suggests the possibility that when mulberry variety V1 which is rich in protein (26.7%), carbohydrates(17.6%) and lipids are fed to silkworms, it is efficiently used for the physiological combustion and improvement in cocoon characters.		

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
8	MOE 3458 (SEEM)	A study on adoption of Pest and Disease Management Strategies in Sericulture	To estimate the extent of damage caused by different pest and diseases on mulberry and silkworm; To determine adoption of management practices for the pest and diseases of mulberry as well as silkworm; To investigate the impact of key personal, psychological, socio-economic and institutional factors on adoption of pest and disease management practices; and To document constraints faced by the farmers in adoption of pest and disease management	B. Gangadhar, M. R. Subrahmanyam, T. Mogili , T. Thirunavukkarasu	Jan. 2012 - June 2013	1.17 lakhs	Fully achieved	The study on the adoption level of knowledge and the perception of the farmers on the occurrence of disease and pest and their management practices revealed that the farmers are aware majority of the harmful pest of mulberry and silkworm. Most of the farmers were aware of the bio-control agents as well as IPM of silkworm pest. The major constraints found to be non-availability of the in puts / bio-control agents. Most of the farmers opined that they wanted the Institute or DoS to arrange supply of the bio-control agents at lower or free of cost and to the place where there is existing crop. Though the farmers were well aware of the insect pests of mulberry and silkworm, they were lacking in the technical know how about the IPM. It is necessary to educate the farmers on IPM practices in mulberry and silkworm and its effectiveness in suppressing the pest population.	Efforts will be made to increase the adoption levels with respect to pest and disease management in the CPP areas of Southern states during XII plan period.	

			practices							

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
9	PPE 3455 (PML)	Habitats studies-Impact of crop diversity on conservation and performance of parasitoids and predators in mulberry crop system	To determine the occurrence of insect pests and abundance of natural enemies in mulberry eco-system under irrigated, semi-irrigated and rain-fed conditions in relation to other crops grown in the vicinity.	J B Narendra Kumar, B. T. Sreenivas, M. Nobel Morrison, V. B. Mathur, R. Meenal	Sept. 2011 - Aug. 2014	2.5 lakhs	Fully achieved	Other crops grown in the vicinity of mulberry does not have impact on the incidence of insect pests of mulberry. Crop diversity in the vicinity of mulberry have significant impact on the multiplication & subsequent recovery of augmented predatory beetles. Mulberry gardens surrounded by mixed crop species with cowpea, castor, maize, sorghum, red gram, cotton, horse gram etc., showed maximum recovery of predatory beetles (488%) and minimum was recorded in gardens surrounded by tomato (280%).	Sericulturists will be suggested to grow mixed crop species or any one or two among the mixed crop depending on the availability of land by the side of mulberry gardens so that the predatory beetles released will have better proliferation and subsequent conservation. This will support conservation of biological control mechanism in mulberry.	

List of concluded projects during 2014-15 (Projects – 07)

Sl. No.	Project Code	Project Title	Objectives	Investigators	**Project period**	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Rem Arks**
10	AIB 3498 (BBL)	Popularization of authorized silkworm hybrids among the farmers of South India	Popularization of the authorized silkworm hybrids for commercial exploitation and	Inter-Institutional CSRTI, KSSRDI, APSSRDI, NSSO, CSTRI)	Nov. 2012 - Oct. 2014	50.90 lakhs	Fully achieved	Bivoltine Hybrids: Field evaluation was under taken by distributing 517350 dfls of bivoltine hybrid CSR16 x CSR17 to farmers of Karnataka, Andhra Pradesh and Tamil Nadu. The	Maintenance of parental breeds is under progress to include in multiplication	

			selection of suitable hybrids					hybrid recorded cocoon yield of 64.30 kg / 100 dfls as compared to 61.18 kg/100 dfls in CSR2 xCSR4. The remaining hybrids, CSR46 x CSR 47, GEN3 x GEN2 and APS45 x APS12 proposed in the project were discontinued due to lower cocoon yields. Multi x Bi hybrids: 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 was 61.52 kg as against 61.0 kg in PM x CSR2 (Control). MH1 x CSR2 performed at farmers' level in terms of cocoon yields, but the reeling performance was not up to the mark. This hybrid performance needs to be monitored further with KSSRDI, Bangalore. The hybrid APDR15 x APDR115 proposed in the project was discontinued due to lower cocoon yields.	channel.	

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11	PIB 3370 (MBG)	Development of superior mulberry varieties by exploitation of hybrid vigour based molecular diversity of promising parental lines	Short-listing promising hybrids for Final Yield Evaluation [FYE] through identification of divergent	Rajashekar, K. S. Gandhi Doss, Rekha, M., M.K. Prithviraje Urs, V. Girish Naik, R. Balakrishna,	Jul. 2006 - Mar. 2015	10.82 lakhs	Fully achieved	Crossing among distant mulberry genotypes resulted in creation of beneficial variability as evidenced by selection of over 2% of the population, which recorded higher values than the population mean plus standard deviation for	Four hybrids that out yielded the check V1 by 11.56 – 19.60% in the primary yield	

			parental lines, hybridization, screening and evaluation of hybrid progeny in Progeny Row Trial [PRT] and Primary Yield Evaluation [PYE].	B. N. Susheelamma, Mala V Rajan, S. B. Dandin				quantitative parameters. Four promising hybrids *viz.*, 4, 6 , 10 and 12 were identified, which out-yielded the check V1 by 11.56-19.60%	evaluation are short-listed for large scale evaluation under future Final Yield Evaluation.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Rem arks**
12	PRE 3486 (Mul. Path)	Development of Database for mulberry diseases	To develop database pertaining to mulberry diseases in India. To develop a web based disease diagnosing system To develop distribution map of important mulberry diseases of India. To develop a web based forewarning system on possible outbreak of the diseases to alert extension functionaries	Prateesh Kumar, P., V. Nishitha Naik, Guneswar Kumar, C.	Aug. 2012-Jul. 2014	2.37 lakhs	Fully achieved	A database webpage Mulberry disease info has been developed and contains following information: Detailed information on 22 mulberry diseases with a brief introduction about the disease, symptom of the disease with photographs, causative organism and its taxonomic position, disease cycle, pre disposing factors, resistant varieties various controlling measures and related literature. Calendar of occurrence of important foliar disease in different mulberry growing states. Diagnostic keys of 13 mulberry diseases with photographs of pathogen, pathogen propagules and infected plants. Distribution map of important foliar diseases of mulberry. Completed projects pertaining to mulberry diseases in various Institutions of India and their findings. About 335 publications made in various journals pertaining to	Linking of the web page with Institutes Website, timely updating of the webpage.Time to time issuing of forewarnings through the webpage.	

								mulberry diseases with titles and their full length PDF files. Various technologies developed for control of mulberry diseases. Frequently asked questions (FAQs) pertaining to various aspects of mulberry diseases and their management. A forewarning system on mulberry diseases to alert extension functionaries and to take precautionary measures.		

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13	AIB 3488 (BBL)	Pre-authorisation field trials of L14 x CSR2: A polyvoltine X bivoltine hybrid with superior fibre quality	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	G.S. Vindhya scientists of main institute & nested units Inter Institutional Project of CSRTI Mysore, NSSO Bengaluru & CSTRI Bengaluru	Apr. 2012 - Mar. 2015	28.50 Lakhs	**Fully archived**	The demerits like variation in larval size, variation in cocoon colour and shape were rectified completely. The seasonal occurrence of trimoulters and hibernation are also within the admissible limits. Further, by exposing selected populations (improved L14 lines) to BmNPV, BmIFV and BmDNV, the new breed MV1 was isolated. The newly isolated MV1 lines show higher survival besides stability in cocoon traits (CV of < 10). The performance of (33 seed crops covering 7060 Dfls) recorded an average cocoon yield of 47.50 kg/100 Dfls. The overall field performance of L14 x CSR2 covering 5,78,425 dfls with 2623 farmers recorded an average cocoon yield of 51 kg per 100 Dfls as against 62 kg for PM x CSR2. The cocoon yield varied from 35 to 65 kg/100 Dfls indicating the instability of crop performance in the field and low cocoon productivity may be due to low expression of hybrid vigour in the L14 x CSR2. L14 x CSR2 is superior over PM x CSR2 in post-cocoon parameters and recorded the silk quality of A~3A. Keeping in view of the crop instability of L14 x CSR2, a new crossbreed combination MV1 x S8 was identified through hybrid evaluation. The new crossbreed MV1 x S8 named as “Cauvery Gold” is productive, plain larvae spin light greenish yellow oval cocoons and characterized by high pupation (>90%), shell percent (20-21), filament length (>800 m), raw silk percent (14-15%) and neatness of 90%. Cocoon yield 60-65 kg/100 Dfls with a renditta of 6.00-6.50 and silk quality of 2A-3A grade. Presently, the new ICB “Cauvery Gold” is under OST.	The newly isolated MV1 breed is uniform in larval size, cocoon color/shape. Preliminary results of newly identified crossbreed MV1 x S8 is encouraging, the same will be further tested in the field.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
14	AIB 3476 (BBL)	Development of Productive NPV tolerant BV Breeds / hybrids carrying BmNOX marker assisted selection	•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	S. K. Ashwath, Virendra Kumar	Apr. 2012 - Mar. 2015	Rs.1.85 lakhs	Fully achieved	BmNOX (NADPH Oxido-reductase) protein marker assisted selection was carried out & 10 NPV tolerant lines have been developed. Nine each of Single & double hybrid combinations have been validated for NPV tolerance. Single hybrid (21 x 35) & double hybrid (21 x 118) x (62 x 87) were identified for OFT & field evaluation.	The selected NPV tolerant hybrids will be evaluated through OFT and field trials for assessing its potential for higher productivity.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remrks**
15	ARP 3477 (S.W. Path)	Therapeutic control of Microsporidiosis in the silkworm through characterization of Methionine Amino Peptidase enzyme genes (MetAP2) in *Nosema bombycis*	•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.	A. R. Narasimha Nayaka, K. M. Ponnuvel (SBRL, Bangalore)	Apr. 2012 - Mar. 2015	Rs.2.00 lakhs	Fully achieved	MetAP2 gene in Nosema bombycis was sequenced and found similar to *Nosema cerenae*. Fumagillin was found effective in suppression of *Nosema bombycis* infection	Fumagillin can be used for the suppression of pebrine disease in silkworm.	

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16	(RTI)	Popularisation of rotary mountages for quality cocoon production funded by JICA	Demonstration of rotary mountage technology along with nylon net in 12 clusters	S. Purushotham	Apr. 2013 - Mar. 2015	Rs.1.00 lakhs	Fully achieved	Conducted live Demonstrations of rotary mountage technology along with nylon net in 12 clusters	Through technology demonstration programmes in the new areas the cocoon quality can be improved.	

List of concluded projects during 2015-16 (Projects – 06)

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	Project Cost	Objectives achieved	Outcome of the Research Project	How the outcome is utilised	Remarks
17	PIG 3502 (Mol. Biol.)	Sustaining mulberry yields: Identification of QTLs conferring resistance to root rot disease by Linkage Disequilibrium mapping and trait introgression (Phase I) – (DBT funded)	Resistance response of mulberry germplasm to major causal fungus of root rot disease (in pot grown plants) Molecular characterization of germplasm accessions and finally identify the contrasts (resistant and susceptible) Develop mapping populations (by crossing of contrasts) in mulberry	V. Girish Naik, D. D. Sharma, Nishitha Naik	Jun. 2013 - Jun. 2015	Rs. 23.22 lakhs	Fully achieved	1.A total of 211 entries of panel of diverse germplasm (PDG) were screened for root rot disease resistance in mulberry using a virulent strain of Macrophomina phaseolina. Based on the disease reaction, resistant (20) and highly susceptible (49) genotypes (contrasts) were identified and categorised. 2.New mulberry specific microsatellite markers (174 F/R primers) were synthesized from the public domain including from the MulSatDB (an in-house web-database for mulberry SSRs) and screened for polymorphism. Among the total, 55 were polymorphic and used in genotyping of the panel. 3.The PDG with 228 entries was	The identified contrasts will be utilized for the development of mapping population and location of QTLs contributing to root rot resistance in mulberry (Project proposal under Mulberry Network Program). Action will be initiated to utilize the identified	

								established in an experimental plot under ARBD for trait evaluation and also as a back-up germpasm.	resistant resources in mulberry crop improvement program by MAS		

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18	PIB 3507 (Mol. Biol.)	Development of Distinctness, Uniformity and Stability (DUS) descriptors for Mulberry (Morus spp.) and their Validation (PPV & FRA funded)	•Develop and validate descriptors for mulberry. •Identify distinctiveness and specific morphological, biochemical/molecular markers, and their stability. •To characterize the extent of variability. •Develop database for the descriptors of mulberry to add on to INDUS (India Database for DUS).	B. B. Bindroo, V. Girish Naik, Gandhi Doss, K. Rajashekar	Apr. 2013 - Mar. 2016	Rs. 9.5 lakhs	Fully achieved	•Identified and validated 35 characteristics with states of expression for DUS testing in mulberry •Selected 32 example varieties for different states of expressions •Draft DUS test guidelines for mulberry was prepared and submitted to PPV & FRA, New Delhi. The Authority constituted Task Force for evaluation and finalization of the DUS test guidelines for the crop which was held on 14.06.2016. Accordingly, the revised DUS test guidelines was submitted to the Authority on 06.07.2016.	The DUS test guidelines for mulberry developed in the project will be used to validate the distinctness, uniformity and stability of extent and new varieties of protection of plant breeders' right and farmers' rights Action will be initiated to test the DUS criterion for important extent and new varieties for plant variety protection	

List of concluded projects during 2016-17 (Projects – 14)										
Sl. No.	Project Code	Project Title	Objectives	Investigators	**Project period**	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
19	AIB 3456 (MBL)	Development of productive polyvoltine breeds of silkworm *Bombyx mori* L. tolerant to high temperature and BmNPV.	1. Development of polyvoltine breeds tolerant to high temperature and BmNPV 2. Identify their Crossbreeds for cocoon productivity and quality	Dayananda, M., Balavenkatasubbaiah, Kariyappa	Oct. 2011 – Sep. 2016	Rs 5 Lakh	**Fully achieved**	The five new polyvoltine lines viz., L1, L3, HB1, HB4 and HB6 developed through selection adopting high temperature and BmNPV pathogen as stress factors Two new crossbreeds viz., L3 × S8 and HB4 × S8, which were significantly superior over the existing popular crossbreed (PM × CSR2) with respect of quantitative and qualitative traits.	The five new polyvoltine lines viz., L1, L3, HB1, HB4 and HB6 which have been developed through selection adopting high temperature and BmNPV pathogen as stress factors would be maintained and effectively utilized in further breeding programmes to develop polyvoltine breeds tolerant to high temperature and BmNPV. HB4 x S8 would be tested in large sacle with selected farmers along with MV1 x S8 as control.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
20	PPF 3500 (RSRS-C.Nagar)	Development of seri-lac culture model for income augmentation. (Collaborative project with IINRG, Ranchi) RSRS C. NAGAR	To work out the additional income generating out of lac production and its economics in relation to mulberry leaf production. To generate the employment for the rural people and improve their livelihood. To study the pest and disease incidence, cross infectivity studies in mulberry and lac host plant.	K. Srikantaswamy, Sibaya Sen, Mohanasundaram	Jun. 2012 - Dec. 2016	3.00 lakhs	**Fully achieved**	Lac host plants were maintained in between the mulberry trees. Lac mother brood culture was mass multiplied at IINRG, Ranchi, procured and inoculated on lac host plants for lac production. Three crops lac production cycle were completed. Lac plantation at one farmer's field (Sri Mahesh, Tumbala village in T.Narasipura Tq.) 8' x 8' spacing was maintained. Two crops lac production cycles were completed. Lac was harvested from lac inoculated plants and quantified (100-150 g of lac harvested per plant and 100 – 150 Kg of lac was generated /acre/crop). Average of three crops' lac production indicated about 150 kg of lac harvested/ac/yr resulted in an additional income of Rs. 46,750.00 The dual culture of silk and lac revealed higher returns of Rs. 1,56,840.00/ac/yr over mulberry as a solo crop (Rs. 1,10,090.00). The cost benefit ratio was higher in Seri-Lac Culture Model (1:2.06) over mulberry as a solo crop (1: 1.74). Besides lac production, the crop residue management after harvesting the lac used as surface mulch indicated significant improvement in soil	Establishment of lac host plants for the production of Lac as an additional income besides mulberry crop production at farmers' field. Seri-Lac culture model would be promoted in suitable areas.	

								fertility status. Development of Seri-Lac culture model paves way for long-term benefits in socio economic development of sericulturists.		

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
21	MOE 3523 (SEEM)	Study on drought management practices in mulberry Sericulture.	1. To analyse the different management practices adopted by farmers to overcome the crisis of drought in mulberry cultivation and silkworm rearing. 2. To study the adoption level of the scientific drought management techniques popularised by the research institutes and to rectify the gaps. 3. To study the preferences and expectations of farmers from research and extension scientists to overcome the crisis effectively	A. Mahima Santhi, Noble Morrison, K.Vedavyasa, M. P. Reddy, Vidyunmala, A. G. K. Daniel, B. Mohan, A.S. Suma	Jan. 2015 - Dec. 2016	5.22 lakhs	**Fully achieved**	The adoption gaps were identified through the dignsotic study (six clusters with 300 farmers) on drought management practices and accordingly the awareness/demos were conducted in the selected clusters. A book on drought management practices was brought-out for farmers in English, Tamil, Kannada and Telugu. The impct study conducted reveals improved adoption levels (25-30%) in drought management practices with the farmers.	Integrated drought management technologies would be popularized in the filed through ECPs and ToT programmes.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**How the outcome is utilised**	**Remarks**
22	MOE 3525 (SEEM)	A study on the impact of pest & disease management practices in sericulture among the farmers under CPP in South India.	To study the impact of adoption of IPM & IDM practices on pests and disease control under CPP area. To study the constraints in adoption of pest and disease management practices	B. Gangadhar, H. Jayaram, T. Mogili, Punithavathi, Ramaprakash	Jan. 2015 - Dec. 2016	Rs. 2.76 lakhs	**Fully achieved**	The data collected from 17 selected clusters (Karnataka, AP, TN and Maharashtra; 850 farmers) revealed that adoption of technology in the control of pests and diseases in mulberry and silkworm through IPM and IDM practices was efficient. The impact of the packages on incidence of mulberry pests and diseases, silkworm diseases was very high. The constraints identified includes lack of availability of IPM inputs, high cost of inputs, lack of awareness about IPM/IDM, especially in Maharashtra for non-adoption. Training of farmers about IPM and IDM measures of pest and disease control will enhance adoption rate. Tomely supply of bio-control agents	Effective dissemination of IPM and IDM packages in the field through ECPs and demonstration programmes.	

								and other critical inputs would improve the rate of adoption.		

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
23	ARE 3526 (PML)	Investigation on Semiochemicals of the silkworm uzi fly *Exorista bombycis*. (In collabora-tion with NBAIR, Bng.)	• To isolate & identify kairomones from mulberry leaf, silkworm larva, fecal 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) • To formulate suitable semio-chemical based trap for uzi fly.	Vinod Kumar, Narendra Kumar, J B., Bhaktavatsalam, N. (NBAIR, Bengaluru) Subhaharan (NBAIR, Bengaluru)	Jan. 2015 - Dec. 2016	13.208 Lakhs	**Fully achieved**	Tricosene was found effective in attracting uzi flies and Tricosane & Pentacosan were identified as minor attractants. 5 mg tricosene per dispenser was effective in trapping the adult uzi flies in the laboratory experiments. Trials with different traps revealed that water pan trap was able to trap adult uzi flies better than sticky or Mc Phail traps in the field.	Pheromone based trap would be validated for the effective management of uzi fly in the field.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
24	PRE 3527 (PML)	Survey & Surveillance of major pests & their natural enemies in mulberry eco-system.	• 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.	J.B. Narendra Kumar, Vinod Kumar, H. Jayaram, Noble Morrison, Pallavi, S. N., N. Sakthivel, Mahiba Helen, Kasi Reddy	Jan. 2015 -Dec. 2016	14.00 Lakhs	**Fully achieved**	Highest mealybug incidence was recorded at RSRS-Salem (12.7%) followed by areas of REC- Srivilliputtur (5.77%) & REC-Madivala (5.41%), RSRS-Anantapur (4.64%) and lowest (2.69%) at REC-Kanakapura (1.48%). Leaf roller incidence was highest at RSRS-Anantapur area (5.65%) followed by CSRTI (4.93%), REC-Madivala (3.8%) and lowest at REC-Srivilliputtur (1.36%). Thrips incidence was highest at RSRS Salem (11.25/leaf) followed by REC-Srivilliputtur (7.04/leaf) and lowest at CSRTI (1.6/leaf). No new pests/natural enemies were recorded during the period.	Pest calendars would be prepared for the selected areas for undertaking timely prophylactic measures and surveillance would be continued for identifying new pests/natural enemies in the field.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
25	AIB 3528 (BBL)	Evaluation of G11 x G19: A new bivoltine double hybrid silkworm for sub-optimal conditions.	To evaluate the field performance of the newly evolved bivoltine double hybrid G11 x G19 for productivity and silk quality.	K.K. Sharmila	Jan. 2015 - Dec. 2016	2.5 lakhs	**Fully achieved**	Parental rearings of G11 and G19 was conducted through 17 adopted seed rearers of NSSO at Palakkad, Mysuru and Bengaluru by distributing 4000 P1 dfls (FCs). A total quantity of 5.0 lakh G11 x G19 hybrid dfls were produced and distributed to the farmers through RSRS/RES/DOS of Karnataka, Tamil Nadu, Andhra Pradesh and Maharashtra. The authorization trials recorded an average yield of 68.0 kg/100 dfls in non-captive area over the benchmark values of 50-60kg/100 dfls. tHe data is being submitted to HAC for hybrid authorization and commercial exploitation.	After authorization of the hybrid, G11 x G19 would be exploited for commercial silk production in non-captive areas under sub-optimal conditions.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**How the outcome is utilised**	**Rem Arks**
26	APR 3529 (SED)	Design and development of silkworm rearing house models for hot & dry and hot & humid areas of peninsular India.	Determination of heat and moisture content (Enthalpy) of air Design(s) of rearing house for creating and maintaining desired levels of temperature and relative humidity by natural and forced ventilation, heating and cooling etc.	V. Sivaprasad, Satish Verma, T. Himantharaj, C. Satyanarayana Raju, D.S Somprakash	Jan. 2015 - Dec. 2016	19,500.00	**Fully achieved**	Studied the existing designs of silkworm rearing houses in non-traditional areas and the prevailing atmospheric conditions. It was hypothesized that the abstract humidity and temperature does not have any bearing on the optimal growth of silkworms. The enthalpy of air is much more important and the rearing houses should be equipped with the heating and cooling devices to maintain optimal enthalpy. The rearing houses models with suitable building materials will be validated.	The rearing house models will be useful to farmers in non-traditional areas of farmers for enhanced silk productivity and quality.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Rem Arks**
27	PRP 3530 (Mul. Path)	Development of a broad spectrum formulation for effective management of mulberry root rot disease.	To develop a broad spectrum formulation for effective management of root rot disease of mulberry	Pratheesh Kumar, P. M., Thippeswamy, T.	Jan. 2015 - Dec. 2016	1.5 lakhs	Fully achieved	Various plant-based, organic and inorganic chemicals were screened agaisnt root rot associated pathogens in vitro and five formulations were developed and tested in vivo under simulated conditions. Rot-Fix was highly effective in the management of root rot and was evaluated in different hotspot areas with 78.77% revival of infected plants. The application of formulation in the initial stages of infection resulted in the 100% revival. Rot-Fix was released in the farmers' workshop held on 17.02.2017 at Doddabalapura, Bangalore.	Popularisation of Rot-fix among the sericulture farmers for management of root rot of mulberry. Filing of patent application and commercialisation of the formulation.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
28	AICEM Phase-III	All-India Co-ordinated Experiment on Mulberry (AICEM) Phase-III	To test and verify the new mulberry varieties for different regions and seasons in different Sericultural zones.	V. Sivaprasad, Director & Zonal Cordinator S. Gandhi Doss, Rajashekar, K. and Rekha, M., CSRTI, Mysuru; M. A. Shantahan Babu and Sathynarayana Raju, RSRS Anantapur; M. Venkatachalapathi, REC Rayachoti; B. Srinath, REC Vikarabad; S. Balasaraswathi and S. Masilamani, REC Krishnagiri; Eshwar, KSSRDI, Thalaghattapura.	Jul. 2011 - Dec. 2015	1,08,000.00	**Fully achieved**	Three test varieties (C2038, G-4 and Suvarna-2) along with Local check (V1) and National check (Vishala) were evaluated for growth, yield attributes, leaf yield, disease and pest incidences for 15 crops in 3 years at 6 centres of South India. Besides, 3 silkworm bio-assays were also conducted varieties and data was recorded for rearing performance. The data ananlysis revealed that MV1 showed significantly superior leaf yield (37.72 -53.34) over MV4 (34.90-51.95) centres and MV5 (31.72-54.92) at three test centres; whereas MV2 showed significantly higher leaf yield (37.28-56.72) over MV4 and MV5 at 5 test centres. Bioassay results indicated that MV2 performed better in all the test centres followed by MV1.	The high yielding variety G-4 would be multiplied and supplied to the Sericultural farmers for utilization.	

								Based on the above observations, MV2 variety (G4) is being recommended to the MVAC for the southern zone.		

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
29	PPA 3551 (RSRS-C. Nagar)	Determination of Yield potential of newly developed bivotine hybrids under Tree type mulberry plantation with protective irrigation.	To determine the productivity of newly developed silkworm hybrids under tree mulberry cultivation and protective irrigation	S.N. Pallavi, R. Meenal	Jan. 2016 - Dec. 2016	1.5 lakhs	**Fully achieved**	Tree Mulberry Cultivation with Protective irrigation was evaluated against traditional mulberry cultivation practices with newly developed hybrids for cocoon productivity. Test hybrids (CSR16 x CSR17), (CSR50 xCSR51), (FC3 x FC4) and (G11 x G19) have shown better performance with leaves fed from mulberry trees in wider spacing using AMIT (coc. yield, coc. wt., shell wt., shell %, filament length & NBFL and raw silk recovery) followed by bush plantation in closer spacing with protective irrigation in three crops.	Tree mulberry cultivation would be popularized as improved cocoon productivity is recorded in the laboratory trials.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
30	PRP 3535 (Mul. Path)	Popularization of Nemahari – A bionematicide for management of root knot disease in mulberry	• 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	V. Nishitha Naik, Prateesh Kumar, Raja Kumar, H. Jayaram, A. Shanthan Babu	Mar. 2015 - Feb. 2017	10 lakhs	**Fully achieved**	Nemahari has been commercialised to Rainbow Agri Life India Pvt. Ltd. Kadapa, Andhra Pradesh for the commercial production. Nemahari was demonstrated in farmers fields of three states with 4243 kgs. The feedback showed 60-80% control of root knot disease with 15-20% increase in yield after the application of Nemahari. Pamphlets have been prepared in regional languages and distributed among the farmers as a part of popularisation of Nemahari.	To further popularise Nemahari among the farmers through regular TOT programmes.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
31	AIB 3536 (BBL)	Development of new bivoltine silkworm hybrids for commercial exploitation.	To develop improved bivoltine hybrids for sustainable productivity	C. M. Kishor Kumar, N. Mal Reddy, S. Manthira Moorthy	Mar. 2015 - Feb. 2017	Rs. 5.40 lakhs	Fully achieved	Utilizing bivoltine breeds (oval: CSR2, CSR17, CSR27, CSR50, CSR52, S8, GEN1, 2C, NB1, D2 and EC1; dumbbell: CSR4, CSR6, CSR16, CSR26, CSR51, CSR53, 4D, 4S, SK6, SK7, DUN17, DUN18, BCon1, BCon4 and Pam117), foundation Crosses (oval x oval / dumbbell x dumbbell), Single Hybrids (oval x dumbbell) and	The single and double hybrids identified for robustness and productivity (SHR1 (D2xSK6), SHP2 (CSR17xCSR26), DHR4 (CSR27x2C)x(Du	

								Double Hybrids (oval x oval) x (dumbbell x dumbbell) were prepared and evaluated. Based on overall performance, best FCs, SHs and DHs were short-listed for further evaluation. The single hybrids (SH) and double hybrids (DH) were further evaluated for productivity and robustness in OST. Single hybrids: SHR1 (D2xSK6) & SHP2 (CSR17xCSR26); double hybrids: DHR4 (CSR27x2C) x (Dun18xCSR16) & DHP5 (S8xD2) x (CSR16xCSR51) were found promising for robustness and productivity, respectively.	n18x CSR16) and DHP5 (S8xD2)x(CSR16 xCSR51) would be tested in large scale in different states and seasons before recommending for commercial exploitation.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	**Project Cost**	**Objectives achieved**	**Outcome of the Research Project**	**Utilization of outcome**	**Remarks**
32	APR-3550 (S.W. Path)	Validation trials of automated disinfection of silkworm rearing house.	To evaluate the effectiveness of Automated Disinfection of silkworm rearing house at in-house level.	A.P. Narasimha Nayaka	Jan.2016 - Mar. 2017	5.00 Lakhs	Fully achieved	Installed automated disinfection units at CSRTI-Mysuru, RSRS-Kodathi, RSRS-Salem and REC-Bidaraguppe. Three crop trials were completed and an average cocoon yield (70.5kg/100 dfls) was recorded which is on par with the manual disinfection methods. Fine-tuning of the automatic disinfection system was undertaken and about 44 such units have been	Automated disinfection system would be established with the farmers in coordination with DoS under ToT programme.	

								established with the financial assistance from DoS-Karnataka on priroity basis.		

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	Project Cost	Objectives achieved	Outcome of the Research Project	**Utilization of outcome**	**Remarks**
33	AIT 3445 (BBL)	Development of robust bivoltine hybrids of silkworm, Bombyx mori L, tolerant to high temperature environment of the tropics through DNA marker assisted selection	a)Identification of DNA markers (SSR) linked to thermo -tolerance in silkworm b)Development of thermo tolerant silkworm breeds / hybrids through DNA marker assisted selection	S. Manthira Moorthy, S. K. Ashwath, Kariyappa	Jan. 2011 - Dec. 2015	17.0 lakhs	Fully achieved	1) Two SSR (LFL0329, LFL1123) markers linked with thermo tolerance in silkworm was identified. 2) Four oval thermo tolerant breeds (TT1, TT2, TT3,TT4) and Four dumbbell thermo tolerant breeds (TT5,TT6,TT7,TT8) was developed employing SSR marker assisted selection. These breeds exhibited 70-84% survival and 18 to 20% shell at 36ºC (5th Instar 2nd day to spinning @ 6hrs daily). 3) Two thermo tolerant single hybrid (TT2 x TT6& TT2 x TT) was developed and it is characterized by 60-65 kg/100 dfls; shell % of 21-22%, reelability of 85-88%, raw silk % of 15-16% and renditta of 6.0-6.5 4) Two thermo tolerant double hybrid [(TT21 x TT67) & (TT23 x TT67)] was developed. The hybrid is characterized with cocoon yield of 60-65 kg/100 dfls; shell % of 22-23%, reelability of 88-90%, raw silk % of 15-17% and renditta of 5.5-6.5.	The identified hybrids would be subjected to On Station trial (OST) at RSRSs to identify best hybrid suited for adverse condition	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	Project Cost	Objectives achieved	Outcome of the Research Project	**Utilization of outcome**	**Remarks**
34	AIB 3506 (BBL)	Studies on Thermo Tolerance, Heat Shock Protein Synthesis during Thermal Shock and Inbreeding in Silkworm, Bombyx mori L (DST-SERB funded)	a) Identification of critical thermal maximum in silkworm b) To analyse the profile of different forms of hsps in silkworm under thermal stress	S. Manthira Moorthy	Jan. 2014 – Dec. 2015	12.0 lakhs	Fully achieved	I) Identification of critical thermal maximum in silkworm. Breeds: CSR2, SK4C Nistari & Pure Mysore ; Treatments : (a) 4 & 5th instar larvae exposed from day1 to spinning at 30, 32,34,36& 38ºC for 3,6,9, and 12 hrs every day, (b) 5th instar 3rd day larvae were subjected to 36,38,40,42 ºC continuously till death/ spinning Irrespective of treatment, high reduction in pupation% was observed in all breeds when larvae were exposed to longer duration (9 & 12hr). The pupation% is varied between 71.5 & 8, 67 & 3, 46 & 0, 32 & 0 in the 5th instar larvae exposed at 38ºC for 3,6,9,12 hrs respectively CSR2 not able to survived on 5th day after 9 &12 hr of exposure. When 5th instar 3rd day larvae were subjected to 36,38,40,42 ºC continuously till death/ spinning, Nistari was able to survive (4%) for 7hrs at 42 ºC, followed by PM (6hrs, 25%), SK4C (4hr,20%) and CSR2(3hr, 40%). Interestingly at 38ºC, Nistari was able survive upto 70hrs(10%) followed by PM (52hr, 4%), SK4C (48hr,14%), CSR2(34hr,10%). Hence 38ºC is ideal for conducing experiments on thermo tolerance in silkworm. Further critical thermal maximum in silkworm is genotype & duration specific. II) To analyse the profile of different forms of hsps in silkworm under thermal stress. SDS page analysis revealed ~11 protein bands in the haemolymph. Of which significant changes observed in expression of ~ 23kDa, ~30kDa ,~ 35kDa , ~70kDa and ~90kDa in all treatments and breeds. 2-D Electrophoresis pattern of CSR2 exposed at 38ºC for 1-5 days for 6hr daily revealed 286 protein spots on first day of exposure to thermal stress, ~ 322, ~ 306, ~337 and ~ 390 on day2, day 3, day 4 and day 5, respectively. The proteins expressed are ranged between ~6kDa to >100kDa. Out of these, several unique expression patterns were observed and some are either up- regulated or down-regulated as compared to control. In general up-regulation of 90-100kDa and shsp (40-35kDa) family and down regulation of 20kDa family during stress. Protein of ~110kDa (pI 8.5) and	This analysis will help to unravel the proteins, which give the thermo tolerance capacity to silkworm at higher temperature and their functional role. Also information would be useful in developing thermo tolerant silkworm	

								~30kDa (pI 3), which was present in control gradually showed reduced intensity indicating under expression over a period of time and to nil expression. Similarly, ~35kDa (pI 9.5) spot also disappeared gradually in subsequent days. A new spot (~72kDa/pI5) appeared after 1st day of exposure, whereas ~64kDa (pI4) protein spot disappeared and a newer ~48kDa (pI8.5) protein spot was present on day 4 protein profile. A total of 7 protein spots were selected for Mass spectrometry from CSR2 subjected to 38°C for six hours daily. Out of seven spots, two corresponded to stress proteins (70kDa, 20kDa) and two matched with protein metabolism (34.24kDa & 59.96kDa). Although the silkworm (B. mori) genome sequence is available, these protein spots could not be matched. After intensified verification, these were predicted as immune-related protein CDIL (58.85kDa) and tRNA ligase (32.65kDa). Yet another spot corresponding to 6.46kDa was identified and classified as an uncharacterized protein.		

List of concluded projects during 2017-18 (Projects – 8)

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	Project Cost	Objectives achieved	Outcome of the Research Project	Utilization of outcome	Remarks
35	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	To identify and select hybrids resistant to root rot and root-knot diseases through hybridization, selection and evaluation in progeny row trial	S. Gandhi Doss, Mala V. Rajan (upto 31-10-2012), M. K. Prithvi Raje urs (upto 09-06-2014), Rajashekar, K., D. D. Sharma (upto 28-02-2014), N. B. Chowdhary (upto 31-05-2013), V. Nishitha Naik (upto 31-05-2016), Pratheesh Kumar, P. M., T. Mogili, Tanmoy Sarkar, T.	Jan. 2012 - Dec. 2017	Rs.7 lakhs	Fully achieved	I & II trial artificial inoculation of pathogens imposed on 35 selected mulberry germplasm accessions and short-listed resistant accessions and high yielding mulberry genotypes. Carried out hybridization involving 16 different crosses and raised (over 10000	The 43 hybrids short-listed from PRT, including root rot and root knot resistant genotypes, will be subjected to PYE experiment, in a separated project, for further evaluation and isolation of promising genotypes with resistance to root rot and root knot diseases.	

				Gayathri and V. Sivaprasad				Nos.) in seed beds. Short-listed and planted 1019 hybrids in PRT (Progeny Row Trial) plot.Based on aboveground biomass, short-listed 112 hybrids and multiplied in nursery.Out of 112 hybrids, short-listed 60 hybrids, having > 60% rooting ability, for artificial inoculation study.Eight crops' data on growth and leaf yield recorded. Identified 43 hybrids showing higher leaf yield (1203 – 818 g/plant) over the population mean and plus 2 standard deviation (411.57 g / plant ± 2 STD, ie., 402.60 = 814.17 g/ plant). Isolated 17 and 24 hybrids exhibiting disease resistance to root rot pathogens and root knot nematodes, respectively. Six hybrids (Nos. 2, 7, 9, 16, 17 & 21) showed resistance		

								response to both root rot pathogens and root knot nematode infections.		

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	Project Cost	Objectives achieved	Outcome of the Research Project	Utilization of outcome	Remarks
36	PPA 3549	Evaluation of modified spacing with special reference to planting geometry for sustainable mulberry leaf production	To identify the appropriate planting geometry for facilitating mechanization and quality mulberry leaf production	Vinod Kumar Yadav (PI) and M. Noble Morrison	Jan. 2016 - Dec. 2017	Rs.5.46 lakhs	Fully achieved	30 farmers who adopted different spacing in three districts of Karnataka such as Ramanagara, Chikkabalapura and Kolar was collected and analysed. (eight crops). Highest average leaf yield/crop/ha (kg) was found in paired row system {(150+90)cmx60cm} (13174.83 kg/ha/crop) which is significantly superior over all other geometry's.	The identified spacing will be recommended for farmers field for popularization.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	Project Cost	Objectives achieved	Outcome of the Research Project	Utilization of outcome	Remarks
37	PRE 3546	Identification, characterization, synthesis and field evaluation of sex pheromone of the mulberry leaf roller, Diaphania pulverulentalis (Lepidoptera : Pyralidae) (In	To isolate and identify the sex pheromones of the leaf roller, D. pulverulentalis To determine the bio-efficacy of sex pheromones against leaf roller To develop suitable pheromone based	J.B. Narendra Kumar, N. Bakthavatsalam2 (PI), N. Morrison1 and Subhaharan2 1REC-Madivala, 2NBAIR-Bengaluru	Jan 2016 – Dec 2017	Rs. 7.00 Lakhs	Fully achieved	Isolated, Identified and synthesized the sex pheromone of the mulberry leaf roller for trapping the males. Three pheromone compounds namely Z-11 hexadecenal, Octadecane and Z-e-7, 11- hexadecenal acetate were isolated and identified. Effective	Sex pheromone lure for mulberry leaf roller pest will be evaluated during the coming season and would be popularized with the farmers.	

		collaboration with NBAIR-Bangalore)	trap for the leaf roller					pheromone compound was successfully synthesised and laboratory evaluation was completed.		

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	Project Cost	Objectives achieved	Outcome of the Research Project	Utilization of outcome	Remarks
38	ARP 3519	Silkworm Disease Monitoring of Seed and Commercial Crop Rearing of South Indian States	To estimate the prevalence of silkworm diseases at selected Basic Seed Farms and Commercial Crop rearings (CPP Clusters) in the South Indian states To suggest remedial measures on spot to the farms/farmers to manage the silkworm diseases and to prevent disease outbreak	M. Balavenkatasubbaiah (upto Dec. 2016), A.V. Mary Josepha, Ramesh Babu (NSSO, upto Dec. 2015), Raghavendra Rao (NSSO, Bangalore, upto Apr. 2017), H.M. Shanbogue (NSSO, Bangalore)	Oct. 2014 - Mar. 2018	Rs.16 lakhs	Fully achieved	Developed web based programme for uploading the disease incidence. BSFs in A.P., KA and T.N. and selected clusters in A.P., KA, Kerala, MH, T.N. and TEL were covered. Data analysis is under progress.	The data on disease monitoring would be used for issuing seasonal disease management measures for farmers and BSFs to be undertaken.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	Project Cost	Objectives achieved	Outcome of the Research Project	Utilization of outcome	Remarks
39	ARP 3597	Standardization and Validation of LAMP (Loop mediated isothermal amplification reaction) technique for the detection of	Standardization and Validation of LAMP based technique For specificity and sensitivity in detection of Nosema bombycis infection in silkworm	V. Sivaprasad, G. Mallikarjuna, L. Satish, S. Manthira Moorthy and A. V. Mary	Oct. 2016 - Sept. 2017	Rs.24.00 lakhs	Fully achieved	Standardized, validated and fine tuned the new LAMP technology developed which is simple, cost effective, less time consuming for detection of pebrine	This technology can be used for detection of pebrine disease in developmental stages of	

		Nosema bombycis infection in silkworm	and silkworm eggs Fine tuning LAMP based techniques for specificity and sensitivity in early detection of N. bombycis	Josepha				disease	*Nosema bombycis* causing pebrine disease.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	Project Cost	Objectives achieved	Outcome of the Research Project	Utilization of outcome	Remarks
40	MOE 3564	Impact of CPP on Sericulture development in North Karnataka	To study the impact of CPP on technology adoption and productivity improvement in sericulture in North Karnataka To study the impact of CPP on socio-economic development of sericulturists in North Karnataka To study the technological efficiency as impact of CPP	Raveendra M. Mattigatti, (PI), H. Jairam, M. K. Raghunath and Y. Sanathkumar	Mar.2016-Sept.2017	Rs. 15.9 lakhs	Fully achieved	Impact of CPP in North Karnataka (2012-2017) resulted in the shift from CB to Bivoltine. CB brushings came down drastically (87%) and BV brushings increased by 276%. Average cocoon yield (kg/100 dfls) increased by 22% and total silk production increased by 50%. The technology adoption increased from 23.2% to 63.4%. With regard to socio-economic impact, the asset position increased by 23.62% (discounted), liability position came down by 6.3%. Sericulture income has increased by 47.2% due to higher production, productivity and market prices. Improvement in animal husbandry, purchase of sericulture/ agriculture equipments and household assets was noticed. Social status improvement (15.86%) was observed with the sericulture farmers.	Policy interventions / implications suggested by the investigators for extending/ popularizing the CPP programme per se would utilized todraw future sericulture improvement programmes in Northern Karnataka and other states as applicable.	

								Cobb-Douglas Production function analysis followed by Technological decomposition model following Bisalaih (1975) was adopted to study the improvement in the technological efficiency as a result of CPP. The non-neutral technological efficiency increased by 15.27%. Nutral technological efficiency was noticed upto 22.35% mainly due to higher labour use efficiency and use of FYM.		

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	Project Cost	Objectives achieved	Outcome of the Research Project	Utilization of outcome	Remarks
41	MOE 3565	Studies on yield gaps in silkworm cocoon production in the states of Andhra Pradesh and Telangana	To identify the yield gaps in silkworm cocoon productivity at farmers' level in Andhra Pradesh and Telangana states. To study the impact of new technologies on silkworm cocoon production	Dr. B. Kasi Reddy Dr. T.Mogili, Dr. G.V.Prasad Dr. T.V.S.Srinivasa Rao Dr. P.Srinivaulu Reddy Dr. B. Srinath	October 2015 – March, 2018	20.40 lakhs	Fully achieved	Information on socio economic characteristics revealed that most of the respondents were in the active age group of 30 - 40 years, educated and small farmers with fewer years of experience in sericulture farming. Fellow farmers (45.30 % in Telangana; 49.5 % in Andhra Pradesh) were major source of information on improved sericultural technologies in the CPP. It was observed that the yield gap I was lower than the yield gap II in case of mulberry leaf production and silkworm cocoon productivity. Before cluster approach in Telangana,	The findings indicate that though the yield gap in both the states in mulberry leaf yield and cocoon production has been reduced after cluster approach, still there are issues/ constraints which need	

								the yield gap recorded was 29.84% in case of mulberry leaf production and 40.06% in cocoon production. After CPP, the yield gaps were reduced to 12.90% & 9.38% respectively. With regard to Andhra Pradesh 26.05% yield gap was recorded in case of mulberry leaf production and 35.24% in case of cocoon production. After CPP, the yield gaps were reduced to 11.21% & 12.48%, respectively with regard to mulberry leaf and cocoon production.	to be addressed to minimize the productivity gaps at field level.	

Sl. No.	Project Code	Project Title	Objectives	Investigators	Project period	Project Cost	Objectives achieved	Outcome of the Research Project	Utilization of outcome	Remarks
42	MOE 3562	**MOE-3562**: Socio Economic Impact of CPP in bivoltine seri farmers in Tamilnadu	To analyze the effect of CPP on technology adoption and productivity improvement in sericulture in the study area of Tamil Nadu; To estimate the socio economic impact of CPP on marginal and small farmers; To elucidate the cost and returns from bivoltine sericulture; To elicit constraints in non-adoption of technology	S.Rajakumar, .E. Rajalakshmi, A.G.K. Daniel, N.G. Selvaraju, G. Punithavathy and Y.Humayun Sharief	**Feb.2016 – Jan. 2018**	Rs.3 lakes	Fully achieved	Technology adoption level ranged from 75 to 92% with a productivity improvement from 69.7kg (2012-13) to 78kg/100 dfls (2016-17). The Dfls Brushing increased from 38.34 lakhs (2013-14) to 73.68 lakhs (2016-17). The critical technologies/practices were adopted to higher levels (80-100%) for achieving the improved productivity. Raw silk production improved from 603 MT (2012-13) to 1627MT (2016-17). Half of the respondents were in old (50.00%) age category and nearly half of them were also high (48.75%) income group. The income earned from	The success of bivoltine silk production in Tamil Nadu would be documented in detail for effective dissemination in other states for improved returns to the farmers.	

								sericulture was invested in digging bore well, children's higher education, purchase of vehicles, marriage arrangements. The net returns from one acre of mulberry ranged from Rs.0.997 lakhs to Rs. 1.575, whereas the cost of production ranged from Rs.245-275. Constraints in non-adoption of technologies were recorded and are being analyzed. The contributory factors for improved production, productivity and socio-economic improvement include good returns from sericulture; effective maintenance of disinfection/hygiene measures during rearing; well established CRCs; suitable rearing houses and adequate rearing facilities; higher adoption of latest technologies; effective crop moinitoring with the co-ordination between CSB & DOS staff and farming communities.		