

FOREWORD



The institute that was established five decades ago during 1961, celebrated its golden jubilee this year. To commemorate this event a National Conference with a theme “Sericulture innovations before and beyond” was organized on 28 & 29 January 2011 at the institute. The exhibition arranged on this occasion depicted the 5 decades of progress and achievements of the institute.

On this golden jubilee year, it is my privilege to present the Annual Report of CSRTI, Mysore for the year 2010-11. The report gives an overall glimpse of R&D, Extension including Transfer of Technology, Human Resource Development and other activities carried out at the institute and its nested units towards development of sericulture in the southern states of the country.

During the period, while efforts were directed towards development of improved mulberry varieties and silkworm hybrids using both conventional and modern biotechnological tools for higher productivity coupled with superior quality under irrigated and rain-fed conditions, the main focus of research was drawn based on the recommendations of the research agenda drawn by the Research Coordination Committee.

The Cluster Promotion Programme for popularization of bivoltine sericulture initiated in the beginning of the XI plan was continued in coordination with the respective state sericulture departments of the southern states including Maharashtra. Technology validation and transfer particularly with reference to cost reduction received priority under the XI Plan Central Sector Schemes. The Institute’s Training Division was got accredited with – ISO-9001: 2008 Certification. HRD programmes included Structured Courses and Certificate Courses for the CSB Officials, field functionaries of states department and farmers. Under Japan International Cooperation Agency (JICA) organized short term and long-term “Third Country Training Programme (TCTP)” to the trainees from different developing countries like Kenya, Uganda, Ghana, Nigeria, Nepal, Madagascar and Kyrgyzstan.

Two superior quality multivoltine hybrids L14 x CSR2 and L15 x CSR2 producing 2A-3A gradable silk were developed, besides authorized three bivoltine hybrids CSR46xCSR47 (a Thermo tolerant); GEN3xGEN2 (for sub-optimal condition); SLD4xSLD8 (Shorter larval duration); and one multivoltine hybrid PMxCSR2 (SL). Papaya mealy bug (*Paracoccus marginatus*) a new pest of mulberry was reported in Tamil Nadu and adjoining areas was tackled following IPM practices and creating awareness programmes initially and later through identification of naturally occurring bio-control agents of PMB and import of proven exotic parasitoids from USDA, Puerto Rico through NBAIL, Bangalore achieving a total control of the pest.

For the first time, under DST-JSPS sponsorship programme, the Institute took collaborative research programmes with National Institute of Agrobiological Sciences (NIAS), Japan on “identification of cDNA markers linked to genes controlling non-susceptibility to BmNPV in the mulberry silkworm *Bombyx mori*. L. whereas another collaborative project was taken up with NBAIL, Bangalore and TNAU, Coimbatore on the study “Papaya mealy bug *Paracoccus marginatus* a new pest of mulberry and its management”.

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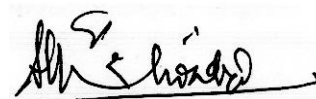
The Institute implemented 65 research projects and 5 Central Sector Scheme, out of which 8 projects were concluded. Few new technologies were evolved as an out come of the research activities and are to be tested at Regional Sericultural Research Stations as On Farm Trials. Popularized some of the proven technologies among farmers through Research Extension Centers. For promotion of bivoltine cocoon production, Farmers' Field Schools were established in 22 clusters of the southern states including Maharashtra under Cluster Promotion Programme (CPP) of CSB. The institute & nested units imparted training to 6479 persons in various sericulture activities. For effective transfer of Sericultural technologies videoconferencing was initiated for the first time in co-ordination with UAS, Bangalore for the benefit of the farmers.

A mega event of farmers and entrepreneurs' workshop was organized first time in North Karnataka at Belgaum, a non traditional sericulture belt to address the problems of sericulture in this area. More than 1500 persons including farmers, entrepreneurs and officials participated in the event.

During the year around 400 research papers were published/presented in various International and National journals, and national and international conferences respectively, in addition two books were published by the scientists of the Institute & nested units. One patent was obtained and three patents were filed during this year.

I put on record the sincere efforts put in by the scientists and other staff of Institute and its nested units leading to significant Research and Development contributions. The effort of nested units in Transfer of Technologies for the progress of the sericulture industry is commendable. The encouragement and support extended by the Hon'ble Chairman, the Member Secretary, Central Silk Board and the active co-operation of State Sericulture Departments of different States, the guidance and support of Chairperson and Members of the Research Advisory Committee and Research Coordination Committee in all the R&D activities are also placed on record. I also duly acknowledge all other administrative and technical personnel, workers who supported directly or indirectly the activities on this institute.

I hope this report will serve as a resource of valuable information for all the stakeholders of sericulture and silk industry as also researchers and academia engaged in sericulture.



(Dr.S.M.H. QADRI)
Director

ABOUT CSRTI

The Central Sericultural Research & Training Institute, Mysore was established under the aegis of Central Silk Board, Ministry of Textiles, Govt. of India. It was started at Channapatna in the year 1961 after taking over the Sericulture Research Institute of erstwhile Mysore province and shifted to Mysore in the year 1963. With the inclusion of the training component, the Institute was renamed as - CSRTI, Mysore in the year 1965. This year the Institute has completed its 60 years of dedicated services for the welfare of sericulturists of the country.

Today the Institute positions itself as the premier institution for sericulture research *par excellence* with all modern facilities and infrastructure. Over the decades the Institute has grown in its stature and gained National and International repute. The Institute undertakes the entire gamut of sericultural R & D activities to cater to the needs of the on-farm sector of the mulberry silk industry of the southern states (Karnataka, Andhra Pradesh, Tamil Nadu and Kerala), Maharashtra, Madhya Pradesh and Gujarat. With its well developed infrastructure and strong indigenously developed technological base, the Institute has made a mark as a leading R & D institution on tropical sericulture in the country and the institute is well recognized as a center for higher learning and advanced training on international front. Its role in generation of trained man power has always been on high pedestals, both at domestic and international levels. So far, it has trained around 30,000 persons in different aspects of sericulture science and technology including 728 foreign students.

Besides conducting research and training on all aspects up to cocoon production, the institute also offers consultancy and advisory services to national and international agencies involved in sericulture activities. The institute also provides support to the farmers, industry and state governments through regular services on pre planned programmes.

The large number of visits to the institute's website www.csrtimys.res.in is a testimony to its roaring acceptance among the scientists, entrepreneurs and farmers.

Vision

To be a model organization second to none for providing R & D services in sericulture to rural development & upliftment and generation of human resources both at Domestic and International level with special reference to tropical conditions / countries.

Mission

- i. Increase in productivity, improvement in quality and reduction in the cost of production.
- ii. Generation of pro-environment, pro-poor and pro-women technologies for effective resource utilization.
- iii. Improvement of field productivity through low cost innovative technologies for overall improvement of socio-economic conditions of sericulturists.
- iv. Human resource development for all levels of operation.
- v. Promotion and popularization of new cutting edge technologies for adoption in the field to increase production base of quality silk.

Mandate

- i. To develop mulberry sericultural technologies suitable to different agro-climatic conditions/zones of south India.
- ii. To conduct basic and applied research in various disciplines leading to the development of appropriate technologies.
- iii. To test verify the proven technologies at field level for their adoptability.
- iv. To conduct front line & first line demonstration with developed technology in the field.
- v. To conduct human resource development and training programmes in the country.
- vi. To co-ordinate all research activities in Genetics, Biotechnology and tissue culture of an advanced nature.
- vii. To serve as the testing centre for all mulberry silkworm related rearing equipment and rearing technologies evolved in CSB institute or referred by other agencies in the states identified for it.
- viii. To coordinate with State Govt., voluntary organisations, NGO's, universities and other national institutes for technology transfer.

Organisational Set-up

CSRTI, Mysore is the largest and most diversified institution engaged in sericultural R & D in the country, supported by about 200 sericultural scientists including Agricultural Engineers, Sociologists and Economists, working in close coordination, both at main institute and in the nested units spread over in the southern states and Maharashtra for development of appropriate technologies and their transfer. The R & D activities and technology developments are carried out in different sections of the four major divisions: **Moriculture, Sericulture, Extension and Training**. The Director monitors the progress of the R & D activities of the Institute and the nested units with the support of Planning, Monitoring, Coordination and Evaluation cell.

Extension Network

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

Training Centre

Human resource development in sericulture is one of the important mandates of CSRTI, Mysore. The institute is recognized as a flagship centre for generation of trained human resource in the field of tropical sericulture. It provides training in tropical sericulture both at international and national level. This Institute is affiliated to University of Mysore for conducting research in Sericulture Technology & bioinformatics including Ph.D. programmes in sericulture. It is also recognized by Dept. of Biotechnology and Dept. of Science & Technology, Govt. of India for conducting various training programmes, especially for socio-economic development and

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technological empowerment of the rural poor, weaker sections and women sericulturists. Besides catering to the HRD needs of the state departments of sericulture, the Institute is also conducting sericulture training programmes for third world countries like Kenya, Uganda, Ghana, Nigeria, Nepal, Madagascar and Kyrgyzstan under its Third Country Training Programme (TCTP) fully sponsored by Japan International Cooperation Agency (JICA), Tokyo.

The training wing houses well equipped class rooms with audio visual gadgets and the programmes are managed by qualified faculty, recognized by various Universities. Hostel facilities are available to accommodate about 125 persons and are equipped with all modern facilities.

So far, the Institute has trained around 30,000 persons, including about 728 foreigners.

Infrastructure / Facilities Available

- ❖ Well equipped laboratories, mulberry gardens and rearing houses to carry out advanced research in sericulture science
- ❖ Large scale rearing houses for technology validation and farmers' training.
- ❖ Model chawki rearing centre (CRC) of 6000 dfls capacity to promote the concept of CRC.
- ❖ Fully equipped Molecular Biology and Biotechnology Laboratories to conduct advanced research at molecular level.
- ❖ Sericultural Engineering workshop facilities to support in designing prototype development and fabrication of machines/ equipment.
- ❖ Computer center with internet (512kbps) connected with all sections through LAN, which provides internet connections to all sections with file and information sharing facilities. The LAN also supports on-line and off-line presentations through multimedia/LCD projectors.
- ❖ Bioinformatics center established with the financial assistance of DBT under the National Bioinformatics Network which provides database retrieval service to the scientists of the different institutions involved in Seri biotechnology research of the southern states.
- ❖ A modern Library with all facilities with a collection of 10448 books, 6760 bound volumes of scientific journals and 85 journals. In addition, it also maintains a collection of dissertations (292), theses (26) and technical reports (32). It also provides CD-ROM database (AGRIS, BIOSIS, BIOTECHNOLOGY CITATION INDEX, EKASWA (Patenting) and DATABASE facilities to its members and bring out half yearly report Seridoc.
- ❖ Publications: CSRTI regularly publishes books, bulletins, leaflets and technical papers related to sericulture. Over 30 books have been brought out till date in addition to a large number of technical and research papers published in leading national and international journals. The institute has the distinction of publishing "Indian Journal of Sericulture" a biannual journal of international repute, Seridoc documenting literature on sericultural sciences and Reshme Vahini (bimonthly) in Kannada for the benefit of farmers.
- ❖ Training wing with modern audio-visual equipment, qualified faculty and hostel facilities.
- ❖ KIOSK installed at Farmers Advisory Centre provides details of all technologies and IVRS is available at toll free number 1800-425-0010

HIGHLIGHTS OF ACTIVITIES AND ACHIEVEMENTS FOR THE YEAR 2010-11

The Institute implemented Sixty five (65) research projects of which five are funded by DBT& DST and 5 are under Central Sector Schemes. During the period 8 research projects were concluded. The major findings during the year are presented below in brief.

Mulberry Improvement, Production and Protection:

- ❖ The Final Yield Evaluation [FYE] of promising genotypes short-listed after screening and evaluation under Primary yield evaluation was continued. Identified two genotypes Gen.3 and Gen.8 superior over check variety (RC-1 and V-1) under sub-optimal and optimal conditions of irrigation respectively by 16-28 %.
- ❖ Identified one triploid out yielding both the National check [S1635] by 17 % and the respective regional checks [S13 / V-1], under soil moisture stress and non-stress conditions by 19 and 37.5 % respectively.
- ❖ Hardened and multiplied eleven lines of transgenic mulberry with HVA1 gene. Recorded data on morphological, physiological and bio-chemical parameters and identified two lines ST11 and ST46 tolerating stress up to 60 days without watering.
- ❖ Under the development of mulberry transgenic plants, leaf explants tissue of V-1 genotype were co-cultivated with the *Agrobacterium* (EHA105) strain harboring the binary construct (pB1121) carrying (i) *SHN1* and *DREB2A* genes under 35 S promoter and (ii) *DREB 2A* and *SHN 1* genes under Rd 29A and Cer 6 promoters respectively. The co-cultivated leaf explants tissue was thoroughly washed and dried and transferred to selection media containing Kanamycin (50 mg/l) and Cephataxime (300mg/l).
- ❖ A range of 20 – 30 % survivability was recorded on selection media, compared to. 60-80 % survival in control. Tissues of putative transgenics (22 Numbers) were supplied to the collaborator - UAS GKVK, Bangalore for confirmation by PCR method. The PCR results have confirmed the transgenics.
- ❖ About 1065 germplasm accessions in the field gene bank at CSGRC, Hosur along with important morphological traits were listed for diversity analysis and short-listing (along with available molecular data). Based on passport and diversity analysis of morphological data, 500 unique germplasm accessions were identified for multiplication in the nursery and for SSR marker analysis.
- ❖ Designed primers (F/R) for 21 SSR repeat motifs from the EST sequences in the NCBI database.
- ❖ Five promising mulberry varieties were evaluated to find out the importance of different treatments *viz.*, organic nutrients, combined effect of organic and inorganic nutrients. Three crop data revealed RC1 and S13 varieties to be more responsive to organic application with higher leaf yield.
- ❖ Towards isolation of rhizosphere phosphate solubilizing bacteria under in-vitro, using standard methods, 3 strains of bacteria showed P solubilization activity in PVK media containing 50 gm / liter Trichloro Phosphate. The solubilization of Trichloro Phosphate started after 24 hr and reached maximum in 5 days. Strain-1 showed maximum PSE value (144) followed by strain-2 (142) and strain-3 (140).
- ❖ Study on long term effect of fertilizers and manures on soil, two crop data showed highest leaf yield in T7 (350:140:140 kg/ha/yr with 20MT/ha/yr i.e., 35.80 in K2, 43.50 in S36 & V1-

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53.50 MT/ha/yr and lowest in T0 (Absolute control i.e., K2-11.80, S36-14.80 and V1-15.90). The micronutrient content in soil varied between different treatments and variety; zinc ranged between 0.35 to 1.30 ppm; copper 0.15 to 0.50 ppm; iron 8.20 – 13.00; and manganese 6.20 to 13.00 ppm.

- ❖ Poshan a multi-nutrient formulation was tested in farmer's gardens. Results indicated an increase of 25 % leaf yield in treated plots than control. Biochemical analysis indicated an increase of 18 to 23 % in total carbohydrates, proteins and total chlorophyll in treated leaf samples over control.
- ❖ Under anaerobic condition, *Pleurotus florida* along with SSP, lime powder, sugarcane bagasse was found effective to decompose the mulberry shoot up to 92% within 150 days. Chemical analysis of the decomposed mulberry shoot showed pH: 7.47; EC: <1.0; OC: 3.06%; N: 0.29 %; P: 0.22% and K: 0.32%. Evaluation of mushroom compost on the soil fertility and leaf productivity revealed improvement of soil health by enhancing soil properties, survival (16%) and growth (19%) over the control.
- ❖ Deep digging (up to 30 cm) along with application of neem oil cake (@ 800 kg/ha after 2 months) and raising of Dhaincha crop (@ 20 kg seeds/ ha after 15 days) was found effective to suppress (98.0 %) soilborne fungal pathogens and nematodes causing root rot and root knot diseases in mulberry saplings.
- ❖ For the identification of the pathogen causing mulberry root rot disease, three bacteria and 4 fungi were isolated and pathogenicity test conducted. Fungal isolate, *Rhizoctonia bataticola* (Anamorph of *Macrophomina phaseolina*) was found pathogenic. The other isolates, *F. solani*, *F. oxysporum* and *B. theobromae* were found to cause secondary infection on roots. Soil temperature >25°C, poor organic carbon < 0.3 %, soil moisture < 30 % and sandy soil enhanced the disease severity.
- ❖ A new formulation composed of plant derivatives (80 %), organic (8%) and inorganic chemical compounds (12 %) was applied in hot spot areas (farmers' field) at Kanakapura and Malavalli. Disease suppression of >90% was achieved within 30 days.
- ❖ For management of soilborne diseases of mulberry using biofumigants, seven Brassicaceae plants were raised, 'in-vitro' screening was conducted against pathogens of root rot disease. Two species viz; *Brassica juncea*, *Raphanus sativus* and mustard oil cake arrested the growth of the pathogen completely. The mustard oil cake and mustard plant residue were also found effective for control of root rot disease under in-vivo conditions.

Silkworm Improvement, Production and Protection:

- ❖ Nine productive breeds (CSR2, CSR3, CSR4, CSR6, CSR12, CSR16, CSR17, CSR26 and CSR27) and thirteen robust breeds (CSR18, CSR19, CSR46, CSR47, CSR50, CSR51, CSR52, CSR53, D2, D20, NB1, S8 and S9) were reared following the race maintenance procedures. The performance of the breeds was in conformity with the original breed characteristics.
- ❖ Thin denier breeds, JPN7 and JPN8 were maintained by following the mono cocoon reeling technique. Both the pure breeds were bred true for the target traits viz., filament length and denier. The performance of the breeds was in conformity with the original breed characteristics.
- ❖ The cocoon colour sex-limited breeds namely, CSR2 (SL), CSR4 (SL), CSR8 (SL) and

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CSR 202 (SL) were reared following the race maintenance procedures. During the course of maintenance of sex-limited breeds, the batches expressing higher survival in females with cocoon weight, shell weight and cocoon shell percentage on par with bench mark values were selected. The performance of the breeds was in conformity with the original breed characteristics.

- ❖ All the productive, robust and sex limited breeds were subjected to post-cocoon assessment. The important post cocoon parameters such as filament length, raw silk percentage, reelability, denier and neatness were assessed. The productive breeds expressed higher raw silk percentage and neatness when compared with the robust and sex limited breeds.
- ❖ To study the performance of double hybrid (CSR50 x CSR52) x (CSR53 x CSR51), the parental breeds viz., CSR50, CSR52 (oval), CSR53, CSR51 (dumbbell) and the foundation crosses namely CSR50 x CSR52 (oval FC) and CSR53 x CSR51 (dumbbell FC) were evaluated. The egg production aspects of the parental breeds and foundation crosses were studied. The double hybrid recorded egg recovery of 87.8 g / kg of cocoons and an average cocoon yield of 70.1 kg/100 dfls.
- ❖ Twenty, three way cross hybrids were evaluated and six three-way hybrids were short-listed. These hybrids recorded pupation > 95%, shell% > 22, filament length (m) of >1200, raw silk of > 19% and neatness of >94 points.
- ❖ Selected batches of bivoltine breeds' viz., Fec14 (CSR2 SL), Fec56 (CSR2) and Fec78 (CSR4), Fec9 (CSR6), Fec10 (S5) and Fec11 (D13) were subjected to directional selection for higher pupation rate (%) and egg number by crossing high pupal weight females with high cocoon shell percentage males from G1 to G10. The breeds meant for higher fecundity have recorded an improvement of 5.29% in fecundity as compared to their controls.
- ❖ Ten promising polyvoltine parents were selected and used as breeding resource material. Ten breeding plans were initiated and 16 lines were identified. Mid-way hybrid evaluation was conducted at F10 generation, 10 lines were short-listed. After hybrid evaluation only 6 lines were retained and continued. Further, at F14 generation, hybrid evaluation was conducted and two promising polyvoltine x bivoltine hybrids - L14 x CSR2 and L15 x CSR2 were identified. Presently the breeding lines are at F19. Pupation in the new hybrids range from 96.67 – 97.3%; Yld/10000 larvae (by Wt.) range from 18.725 to 18.798 kg; Cocoon wt. 1.945 – 1.955g; Shell wt. 0.400 to 0.419 g; and Cocoon Shell % 20.60 to 21.43; Filament length ranged from 990 to 995 m; RS % 16.24 to 16.65 %; neatness 91 points and Raw silk % from 16.24 to 16.65 % with a quality silk of 2A Grade. Grainage parameters have been studied in promising breeds L14 & L15.
- ❖ The newly identified cross breed hybrids L14 x CSR2 & L15 x CSR2 have been evaluated under large scale testing at TVDC and found to be superior over ruling hybrid PM x CSR2. During the period two On Station Trials have been conducted at three RSRs (Ananthapur, Kodathi and Salem).
- ❖ Eighty one hybrid combinations involving 7 bivoltine breeds & 2 FCs viz., CSR2, CSR4, CSR6, CSR26, CSR27, CSR50, CSR51, CSR2 x CSR27, CSR6 x CSR26 and 9 polyvoltine breeds viz., ND7, ND5, NP1, NDV6, AGL3, AGL5, L14, L15 and PM have been evaluated in the laboratory. One hybrid evaluation trial has been completed during summer March-April 2010.
- ❖ Evaluation indices have been calculated for all the 81 combinations using Mano's EI. 47

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hybrids have recorded > 50 EI values. Following are the top ranking hybrids based on first trials results. 1. L14 x CSR2, 2. L15 x CSR2, 3. L14 x CSR50, 4. L15 x (CSR2 x CSR27) and 5. AGL3 x CSR26. 2nd trial evaluation involving 110 hybrids is under progress.

- ❖ Single and double hybrids with high amylase activity as well as tolerance to high temperature (36°C) and high humidity (85% R.H.) conditions were identified. In-house testing at TVDC and On-station trials at RSRS, Units have indicated the superiority of the single hybrid, 2C x 4S and double hybrid, G11 x G19 over the controls in terms of higher survival and pre/post-cocoon traits.
- ❖ Twenty silkworm breeds developed through amylase marker assisted selection, 6 recurrent parents, 15 NPV tolerant breeds and 35 mutant stocks were reared and maintained conforming to their respective breed characters.
- ❖ Inheritance analysis of bimodal emergence has been analysed under three trials.
- ❖ Amplified products of two SNP primers showed linkage with 4 band and 5 band cathodic amylase genes of PM and Nistari. Two primers of 21st linkage group showed close association with cocoon traits.
- ❖ One tolerant and one susceptible parent have been selected and BmIFV pathogen has been multiplied and purified. DNA has been extracted from the parents. Genomic DNA from F1, F2 and BC progeny is being screened with RAPD primers to establish SCAR markers against BmIFV.
- ❖ Twenty one bivoltine and twelve multivoltine artificial diet breeds have been maintained as breeders stock for original breed characters.
- ❖ Four trials of muga diet rearing conducted at CMERTI, Jorhat and two trials at CSRTI, Mysore. 87.26 % average feed response was recorded. 85.75 % larvae successfully passed II moult. Maximum weight recorded on diet for 10 I instar larvae was 0.4325g and for II instar larvae 1.4208g. Patent filed for Muga diet.
- ❖ One field trial cum demonstration for both Tasar and Eri diet chawki rearing was conducted in co-ordination with DOS, Chattisgarh. 30 officials were trained. Significantly higher ($p < 0.001$) shell weight (0.486g) and shell percentage (14.21) recorded in diet reared Eri cocoons compared to leaf-reared batch (0.398g & 11.92%). In Tasar diet rearing, non significant difference was recorded in all rearing parameters except in cocoon yield where diet reared batch showed significantly higher ($p < 0.001$) cocoon yield (1300 cocoons) as compared to leaf control (1015 cocoons).
- ❖ Eight *Cordyceps spp* and other species were obtained from various sources and the pure mother cultures are being maintained. Different media are being tested for better performance of the fungus.
- ❖ Achieved 18% improvement in egg laying capacity in PM silkworm breed using appropriate oviposition stimulants.
- ❖ Pink natural colour fabric has been tested through Textile committee and CSTRI, Bangalore for colourfastness and fabric properties respectively. It was found that colourfastness was good to excellent in all respects except colourfastness to light. Colour fabric properties were at par with normal silk fabric (dyed).
- ❖ Silkworm pure races viz., L13, L14, L15, ND7, PM, Gen2, Gen3, CSR16, CSR17, CSR50, CSR51 were reared on large scale and rearing packages are being developed.

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- ❖ Two trials of bivoltine double hybrid (CSR2xCSR50) x (CSR51xCSR26) evaluation with control (CSR2xCSR27) x (CSR6xCSR26) were conducted with a total of 432 dfls. The average of two trials recorded a cocoon yield of 89.07 kg/100 dfls, ERR of 94.36 % as against 78.76 kg and 92.84% with an improvement of 13.09 % and 1.63% respectively in the control hybrid. The new hybrid showed an improvement of 1.98 in the shell percent over the control. Two more double hybrid (CSR52xCSR50) x (CSR51xCSR53) and Gen11x Gen19 have been identified and the initial results are found promising.
- ❖ Three trials of L14 x CSR2 hybrid rearing recorded a cocoon yield of 72.24 kg/100dfls as against 62.269 kg, an improvement of 16.13% over the control PM x CSR2 and the Shell % of the new hybrid showed an improvement of 12.85% over the control. The silk obtained from the new hybrid found suitable for both warp and weft because of its superior quality.
- ❖ Two trials of L4 x CSR2 hybrid recorded a cocoon yield of 67.635 kg/100dfls with an improvement of 8.62% over the control. The shell % showed an improvement of 5.97% over the control.
- ❖ A total quantity of 4,98,316 bivoltine seed cocoons and 25,320 multivoltine cocoons received from different stations/ sections of the institute were processed and layings were prepared.
- ❖ Selected breeds were tested for their tolerance against BmIFV infection and breeds 5N and 51N were found tolerant and CSR2 as susceptible. The hybrids viz. 5N x CSR2 and CSR2 x 5N were also inoculated with BmIFV and estimated their tolerance towards the pathogen.
- ❖ The impact of a new microsporidian isolated from the silkworm rearings of P3 BSF Mysore on silkworm larval health and cocoon characters was studied. The larval and cocoon characters were not affected by the infection of silkworm with the spores of this microsporidian spore at the concentration of 1×10^3 to 1×10^6 spores /ml. The pathogenecity studies of the new microsporidian in two successive generations were completed. The layings laid by female moths having infection up to 5 spores/field and 100 spore/field (600 x magnification) were allowed to rear. The infection resulted in 2% and 3.33% mortality in larval/pupal stages. At moth stage no moth was found infected at 5-spores/field infections whereas, 83.66% infection was resulted in 100-spores/field infection.
- ❖ To popularize biological control of sericultural pests, 10,500 *Cryptolaemus* and 1,16,750 *Scymnus* beetles were supplied to sericulturists of Karnataka, Tamil Nadu, and Andhra Pradesh for the control of tukra in mulberry covering 275 acres.
- ❖ To reduce the incidence of Uzi fly, 92.7 Lakhs (927 packets) of *N. thymus* were supplied to the sericulturists of Karnataka, Tamil Nadu, Andhra Pradesh and Maharashtra covering 46,350 layings.
- ❖ Under the collaborative programme with TNAU and NBAIL, 3 exotic parasitoids of Papaya mealy bug viz, *Anagyrus loecki*, *Acerophagus papayae* & *Pseudleptomastix mexicana* were imported from USDA during August 2010 & developed a classical biological control for management of Papaya mealy bug.
- ❖ A total of 15,100 adults of *Acerophagus papayae* parasitoids under classical biological control programme were released in papaya mealy bug infested mulberry gardens of 25 farmers in Tamil Nadu and 34 farmers in Karnataka. After the release of parasitoids, the infestation reduced from 10-80% to less than 2% resulting in more than 90% suppression.

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- ❖ Since 5 years, continuous release of lady bird beetles in 70 acres of mulberry garden & *N. thymus* in rearing houses at CSRTI, Mysore was able to keep the incidence of tukra & uzi fly below 5% level without the application of any chemical/insecticide.
- ❖ Monitored the incidence of minor pests such as white fly, thrips & mites and awareness cum demonstration programmes were conducted in hot spot area of Mandya and Kanakapura.
- ❖ Under studies on forecasting & forewarning for mulberry pests, diseases, and silkworm pest, Incidence of pests and diseases of mulberry is being recorded at selected mulberry gardens in seven different locations (in Karnataka 03; Tamil Nadu: 02; Andhra Pradesh: 2) on fortnightly basis and data compilation is under progress.

Transfer of Technologies and Extension activities:

- ❖ Cluster Promotion Programme (CPP) is implemented in 22 identified clusters in Karnataka, Andhra Pradesh, Tamil Nadu and Maharashtra in co-ordination with respective Departments of Sericulture for the promotion of bivoltine sericulture in the country. The clusters are supported with Chawki Rearing Centres (CRCs), Farmers' Field Schools (FFSs), Seri-polyclinic and biological control agent multiplication units for supporting the farmers for successful harvest of bivoltine crops. A total of 32,54,783 dfls of bivoltine hybrids were distributed under CPP to 15,471 farmers and an average cocoon yield of 64.42 kg/ 100 dfls was harvested.
- ❖ A total of 1,05,600 dfls of bivoltine hybrids were chawki reared in the model CRC of institute and supplied to 374 adopted farmers of CSRTI, Mysore. An average cocoon yield of 68.69 kg/100 dfls was recorded.
- ❖ For effective transfer of technologies, Video Conferencing was initiated in co-ordination with University of Agricultural Sciences, Bangalore. Four sessions were conducted with participation of farmers from different regions of Karnataka.
- ❖ Provided technical guidance/ solutions to 81 farmers through Farmers Advisory Center (FAC). 193 farmers utilized IVRS (Interactive voice response system) facility for getting information on various aspects of sericulture.
- ❖ Provided awareness regarding general sericulture and sericulture technologies to 3,593 farmers, 1,484 students, 370 trainees and 97 persons from different counties during their visit to CSRTI, Mysore.
- ❖ Organized a Farmers' workshop at Belgaum on 5.01.2011. More than 1000 farmers participated in the workshop.

Human Resource Development:

As per the Institute's mandate, training was imparted to 6479 persons in various sericulture activities. The details are as follows:

(a) International Training Programme: Third Country Training Programme (TCPC) was organized under JICA sponsorship under which 28 trainees participated from eight developing countries viz., Kenya, Uganda, Ghana, Nigeria, Nepal, Laos, Madagascar and Kyrgyzstan.

(b) National Training programme:

- ❖ Enterprise Promotion and Training under XI plan of CSS: 5705

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- ❖ Certificate course: 64
- ❖ Number of framers trained under ad-hoc programmes: 589
- ❖ Training under NRDC programme:98

Patents filed/obtained:

- ❖ A diet for rearing young instar muga silkworm and a process for preparation there of (IPR/4.11.13/10055/2010)
- ❖ Development of sericin extraction process from sericin rich bivoltine silkworm hybrid cocoon shell (IPR/4.4.4/09103/2010)
- ❖ Navinya – A bio formulation for control of root rot disease (IPR/4.25.14/10079)
- ❖ Semi synthetic diet for rearing of young instar tropical tasar silkworm, *Antheraea mylitta* (Pat.No.240259/30.4.2010)

Books and Technologies released:

I. Golden Jubilee National Conference on Sericulture Innovation Before and Beyond, held on 28th & 29th January 2011.

A. Books released:

- ❖ Souvenir – Golden Jubilee National conference on Sericulture innovations: Before and Beyond
- ❖ Book of Abstracted papers - Golden Jubilee National conference on “Sericulture innovations: Before and Beyond”
- ❖ Lead papers – Silkworm Breeding in India status and Strategies
- ❖ Indian silk - Special Issue

B. CDs released:

- ❖ Five decades of Research and Development at CSRTI, Mysore – A Technological Journey
- ❖ Growth Indices of silkworm *Bombyx mori*

C. Technology released:

- ❖ Technology “Navinya” – A new plant based formulation developed for the management of root rot disease of mulberry

D. New authorized silkworm hybrids released:

- ❖ SLD4 X SLD8 (Bivoltine hybrid with shorter larval duration)
- ❖ PM X CSR2 (SL) Multivoltine X Bivoltine hybrid for egg producers
- ❖ CSR46 X CSR47 (Thermo tolerant bivoltine hybrid),
- ❖ GEN3 X GEN2 (Bivoltine hybrid for sub-optimal conditions),

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II. Farmers Workshop on “Sericulture Industry in the progress of North Karnataka” (Reshme Krishi Mela) held on 5.3.2011 at Belgaum.

A. Books released:

- ❖ Technology book entitled “*Reshme Krishiyalli Avishkaraka Thanthragal Kaipidi*” in Kannada.
- ❖ A Kannada book entitled “*Reshme Krishi Kshethra Margadarshike*”.

B. Technology released:

- ❖ A technology “*Poshan*” – A multi nutrient formulation for correction of the physiological disorders caused by the deficiencies of both macro and micronutrients.

Workshops and Seminars:

For effective transfer of technologies among the sericulturists, and to facilitate interaction among scientists and planners, the institute and RSRSs had conducted following events during the year.

1. Awareness programme on Papaya mealy bug for sericulturists of Mysore district at CSRTI, Mysore on 28th July 2010.
2. Workshop on “Success of Bivoltine Sericulture under Cluster Promotion Programme in Tamil Nadu”, was conducted at Salem by RSRS Salem on October 6, 2010.
3. Interactive Session on Silkworm Breeding at SSBS, Coonoor from 2-3rd December 2010.
4. Workshop on Bio informatics and its Application at CSRTI, Mysore from 20-21st December 2010.
5. Interactive Session on Bivoltine silkworm Breed multiplication and Maintenance at CSRTI, Mysore on 22nd January, 2011.
6. Golden Jubilee National conference on Sericulture innovations: Before and Beyond from 28-29th January, 2011.
7. Krishimela was conducted by RSRS Salem on 12.2.2011 at TNAU, Coimbatore in coordination with the Department of Sericulture, Tamil Nadu.
8. Farmers Workshop on “Sericulture Industry in the progress of North Karnataka” (Reshme Krishi Mela) held on 5.3.2011 at Belgaum.
9. Workshop on official language “Hindi noting and drafting” for scientists conducted at CSRTI, Mysore from 7 & 8th March 2011.
10. Sericulture Farmers workshop on “Contract Farming in Sericulture” was conducted by RSRS, Ananthapur in association with, Andhra Pradesh Department of Sericulture at Hyderabad on 22-23 March 2011.
11. Workshop on “Entrepreneurship in sericulture” at Vivekanada college of Arts and Science for Women, Tiruchengode, RSRS Salem on March 8, 2011.

Publications for Transfer of Technology:

A total of 358 Research papers/ popular articles and conference papers were published by the scientists of the Institute & nested units (International Journals: 39; National Journals: 54; Papers presented in Conference : 220; and popular articles: 45)

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Institute's Publications:

- a) Indian Journal of sericulture : Bi-annual
- b) Seridoc : Bi-annual
- c) Reshme Vahini (Kannada) : Bi-monthly
- d) Pattuvignanam (Telugu) : Bi-monthly
- e) Books/Booklets/ Pamphlets : As per requirement

Visitors:

A total number of 6426 persons visited the Institute during the year:

Farmers	: 3988
Students/Trainees	: 1484
Others	: 467