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रेशमकीट बीज प्रौद्योगिकी प्रयोगशाला
SILKWORM SEED TECHNOLOGY LABORATORY



रेशमकीट बीज प्रौद्योगिकी प्रयोगशाला

राष्ट्रीय रेशमकीट बीज संगठन

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NATIONAL SILKWORM SEED ORGANIZATION

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रेशमकीट बीज प्रौद्योगिकी प्रयोगशाला, राष्ट्रीय रेशमकीट बीज संगठन, केंद्रीय रेशम बोर्ड, कोडति, बेंगलूरु ने स्थापना के प्रारंभ से ही शरीर क्रिया विज्ञान, बीज रोग विज्ञान एवं मानव संसाधन सहित रेशमकीट बीज उत्पादन और विकास के अनुसंधान एवं विकास में प्रमुख भूमिका निभाना जारी रखा है।

शहतूत एवं एरी रेशम कीट के अंडे की उपज को बढ़ाने के लिए नये वाष्पशील पदार्थों का विकास तथा तसर बीज कोकून संरक्षण कार्यक्रम, संस्थान की प्रमुख उपलब्धियाँ थी। संस्थान ने प्रभावी टीओटी कार्यक्रमों के अलावा, नियमित प्रशिक्षण (सीबीटी) और बीज अधिनियम प्रशिक्षण कार्यक्रम आयोजित करके मानव संसाधन विकास गतिविधियों में सरहनीय प्रगति प्राप्त करने के अलावा कर्नाटक, आंध्र प्रदेश और तमिलनाडु के बीज क्षेत्रों में संयुक्त रेशमकीट रोग निगरानी सर्वेक्षण आयोजित करने में महत्वपूर्ण भूमिका निभाई है।

रेशमकीट बीज प्रौद्योगिकी प्रयोगशाला ने गुणवत्ता मानकों का पता लगाने के लिए भ्रूण, रेशमकीट, माँथ और रेशम अंडे के खोल परीक्षण आयोजित करके रेशमकीट बीज क्षेत्र के हितधारकों का समर्थन किया। इसके अलावा रे. बी. प्रौ. प्र. वाणिज्यिक रेशमकीट बीज के निर्यात के लिए संगरोध प्रमाण पत्र जारी करने में भी अपना योगदान दिया।

वर्ष 2020-21 की वार्षिक रिपोर्ट प्रकाशित करने में वैज्ञानिकों, तकनीकी, प्रशासनिक एवं सहायक कर्मचारियों की सभी सेवाएं प्रशंसनीय हैं। साथ ही यह सुनिश्चित करना चाहता हूँ कि, यह रिपोर्ट रेशमकीट बीज प्रौद्योगिकी / उत्पादन क्षेत्र से संबंधित शोधकर्ताओं के लिए एक सूचना स्रोत के रूप में काम करेगी।

डॉ. आर. के. मिश्रा
निदेशक, रा रे बी सं

Foreword

Silkworm Seed Technology Laboratory, National Silkworm Seed Organization, Central Silk Board, Kodathi, Bangalore since inception continued to play prominent role in Research and Development in different areas of Silkworm Seed production including Physiology, Seed pathology and Human Resource Development.



Development of New volatiles for enhancement of egg yield for mulberry and Eri silk moths and Tasar seed cocoon preservation schedule, were major achievements. The blends developed for enhancing egg recovery were found to increase the egg recovery by about 13- 16% in different silkworms. The institute played pivotal role in conducting Joint Silkworm Disease Monitoring Surveys in seed areas of Karnataka, Andhra Pradesh and Tamil Nadu besides supporting human resource development activities in the area of Silkworm Seed Technology in addition to effective ToT programs.

Silkworm Seed Technology Laboratory also supported the stakeholders of silkworm seed sector by conducting embryonic analysis, silkworm / silk moth and egg shell testings to ascertain quality parameters. Besides, SSTL was also involved in issuing Quarantine certificate to the Seed Producers for export of commercial silkworm seed.

All the efforts of Scientists, Technical, Administrative and supporting staff were appreciable to bring out the Annual Report for the year 2020-21. I wish and ensure that, this report will serve as an information source for the researchers working in silkworm seed technology / production area.

(Dr. R. K. MISHRA)

Director, NSSO

अनुसंधान एवं विकास गतिविधियों की मुख्य विशेषताएं

- ❖ कवक (साइजोफिलम) द्वारा रूपांतरित करक्यूमिन मेटाबोलाइट उत्पाद का मिश्रण तैयार किया तथा रेशमकीट रोगजनकों, (*स्टैफिलोकोकस प्रजातियों*) के खिलाफ कृत्रिम परिवेश में तैयार मिश्रण का अध्ययन किया। इस शोध से यह पता चला की, मेटाबोलाइट उत्पाद मिश्रण से उपचारित रेशमकीटों की उत्तरजीविता में 14% का सुधार हुआ।
- ❖ बाइवोल्टाइन शहतूत रेशमकीट में अधिक अण्डों के उपज के लिए तैयार मिश्रण ने प्रायोगिक नियंत्रण (85 ग्राम) की तुलना में 13% अधिक अंडा उपज (97 ग्राम प्रति किलोग्राम कोकून) प्रदर्शित किया।
- ❖ 7.5 डिग्री सेल्सियस पर तीस दिनों तक संरक्षित डीटीवी तसर बीज कोसों ने 49 दिनों में प्रायोगिक नियंत्रण (95%) की तुलना में 18 दिनों के भीतर 96% कीटों का कोकून से निकलना पाया गया।
- ❖ डीटीवी एवं डीबीवी बीज कासो, फोटोपिरियड (16h L: 8h D) के अधीन प्रायोगिक नियंत्रण (क्रमशः 49 एवं 40 दिन) की तुलना में अग्रिम रूप से कीट उद्भव पैटर्न / लय का अवलोकन किया (क्रमशः 22 एवं 29 दिन)।
- ❖ भारतीय बागवानी अनुसंधान संस्थान, बेंगलुरु के सहयोग से एरी और मूगा रेशम कीट के लिए कृत्रिम मिश्रणों का विकास किया और प्रयोगशाला के स्तर पर परिक्षण करने पर अंडोपज में १६ प्रतिशत की वृद्धि देखने को मिली।
- ❖ संयुक्त रेशमकीट रोग निगरानी सर्वेक्षण (सं रे रो नि स) के तहत, आंध्र प्रदेश, कर्नाटक और तमिलनाडु में 10 सर्वेक्षण कार्यक्रम आयोजित किए गए। केंरेअवप्रसं, मैसूर के सहयोग से केंरेजसकें होसुर, पी3 मूबीफा, बेरीगई एवं अवलापल्ली, रेशम निदेशालय, तमिलनाडू तथा पी3 मूबीफा, मैसूर के रोग सर्वेक्षण में भी भाग लिया। द्विप्रज और बहुप्रज के 4,831 नमूनों के साथ कुल 1,746 लॉट का परीक्षण करके रिपोर्ट किया गया।
- ❖ सीबीटी कार्यक्रम के तहत 6 प्रशिक्षणों में 52 प्रतिभागियों को प्रशिक्षित किया गया। बीज अधिनियम के तहत 02 प्रशिक्षण 03 माह के लिए आयोजित किए गए और कुल 07 आरएसपी को प्रशिक्षित किया गया।
- ❖ टीओटी कार्यक्रमों के तहत 6 कार्यक्रम आयोजित किए गए और 115 हितधारकों को संवेदनशील बनाया गया।
- ❖ वर्ष 2020-21 के दौरान रॉयल्टी (अनुसंधान विकास उत्पादों के व्यावसायीकरण के द्वारा), प्रशिक्षण, उत्पादन व व्यवसायिक संकर बीज उत्पादन के लिए बीज कोसों का उत्पादन एवं कीटाणुनाशक/रेशम कीट/भ्रूण परीक्षण शुल्क आदि के द्वारा कुल 13, 70,103/- रुपयों का राजस्व अर्जित किया।

HIGHLIGHTS OF R&D ACTIVITIES

- ❖ *In vitro* activity of the microbially converted metabolite from Curcumin by the fungi *Schizophyllum* exhibited higher antibacterial activity (14% over the parent compound) against flacherie causing *Staphylococcus* sp.
- ❖ The blend developed for higher egg recovery in bivoltine mulberry silkworm under large scale testing exhibited 13% higher egg recovery (97 g per kg cocoons) against control (85 g).
- ❖ Preservation schedule of 30 days at 7.5°C for DTV and DBV Tasar Seed cocoons was developed with 96% and 92% of moth emergence within 18 and 31 days in DTV and DBV was recorded against the control (95% in 49 days. In DTV and 80% in 40 days for DBV).
- ❖ Preservation of seed cocoons at photoperiod of 16h L: 8h D for DTV and DBV Seed cocoons for one month advanced the moth emergence within 22 days in DTV and 29 days in DBV against 49 days and 40 days, respectively in control batches.
- ❖ Developed three synthetic blends for higher egg recovery in Eri silk-moth in collaboration with IIHR, Bengaluru, exhibiting about 16% enhancement in egg laying against control.
- ❖ Under Joint Silkworm Disease Monitoring Survey (JSDMS), conducted 10 survey programs in Andhra Pradesh, Karnataka & Tamil Nadu. Disease survey was also attended in collaboration with CSRTI, Mysore at CSGRC, Hosur; P3 BSFs Berigai & Avalapalli of DoS, Tamil Nadu and P3 BSF, Mysore. A total of 1,746 lots with 4,831 bivoltine and multivoltine samples were tested.
- ❖ A total of 59 persons were provided training under different programmes (52 under CBT and 7 under Central Seed Act).
- ❖ Under ToT programs, 6 events were conducted and sensitized 115 stakeholders.
- ❖ Generated a total sum of Rs.13, 70,103/- revenue through Royalty (for commercialization of R&D products), Training, Generation and supply of Seed cocoons for commercial hybrid seed production and Disinfectants/Silkworm / Embryonical Testing charges.

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Director	Dr. R.K. Mishra
Scientist-D & Head	Dr. K.M. Vijaya Kumari
Scientist-D	Dr. Veeranna Gowda Dr. P. Sudhakara Rao (upto April 2020) Dr. Chandrashekar R Hegde (from July 2020)
Scientist-C	Dr. Sailaja Bandam Dr. R. Saravana Kumar
Senior Technical Assistant	Mr. S. Nataraj (Retd. July, 2020) Mr. S. Muralidhara Mr. R. Rajasekar Mr. J. N. Chandrashekar Mr. V. Chandrashekara Reddy Mr. B.V. Raviprasad Mrs. K. R. Rathnamma
Field Assistant	Mr. H. N. Harish
Junior Research Fellow	Mr. Gokulraj Ms. Kamar Taj
ADMINISTRATIVE PERSONNEL	
Assistant Director (Computer)	Mr. M. Thandapani
Assistant Superintendent	Mr. S. Rajendra
Junior Engineer	Mr. K.S. Venkatachalapathy (Retd. - May 2020)
Driver	Mr. A. Sathyaseelan Mr. Shivaji
Assistant Technician	Mr. M.S. Yogannachar
Multi Task Staff	Mr. L.H. Hemanna Gowda Mrs. N. Vijayalakshmi Mr. Lakshminarayana

PART I: ON-GOING RESEARCH PROJECTS

1. ARP-3634: Microbial transformation of eco-friendly compounds for the management of silkworm (*Bombyx mori* L) diseases (March 2018 - May 2021)

Dr. R. Saravanakumar and Dr. P. Sudhakara Rao

Silkworm diseases are persistent problems for silkworm and silk industry. The crop loss or low yield due to different silkworm diseases is continuing during different seasons. There is a need to identify high active systemic compounds to control the diseases. Since production of compound functionalized by chemical methods is more complicated, microbial conversion method has been a new approach which can modify the compounds or convert into another form easily. Hence, this study aimed to develop new antimicrobial compounds with improved activity through biotransformation of existing chemicals that helps to control the silkworm diseases efficiently.

During the period under report, a total of four purified compounds were studied for microbial conversion through inoculation with 12 fungal cultures. The parent compounds (20mg/ml concentration) inoculated with fungal cultures in PDB media were incubated at 25-28°C in incubator shaker (120 rpm) for 11 days. The product formation was tested periodically to identify the transformed products through Thin Layer Chromatography (TLC) and visualized using Iodine vapour.

To test the activity of the converted products, *in-vitro* studies were done by incubating the silkworm bacterial pathogens (1×10^9 spores/ml) overnight on a Muller Hinton agar plate. Filter paper discs (6 mm diameter) dipped in the product solution of various concentrations were kept on inoculated plates and incubated at $32 \pm 1^\circ\text{C}$ for 24 hours. The development of inhibition zone around the disc was measured and the diameter of the inhibition zone indicated the antibacterial activity of the product.

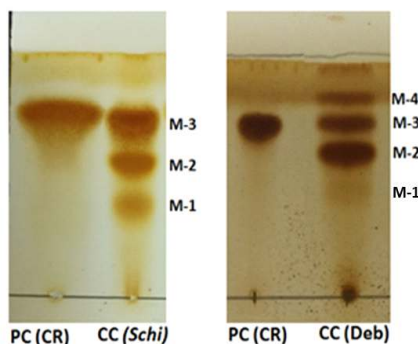
Results

Identification of converted compounds

Three metabolites (derived compounds) were detected as produced in Curcumin treated with the fungus *Schizophyllum*, and when treated with the fungus *Debaromyces*, it produced four new metabolites (Fig.1). All the four new products appeared on 5th day of the reaction and persisted upto 14th day in the reaction mixture (Fig. 1 & Table 1). The new compounds, 1-3, produced by both fungi (*Schizophyllum sp.*, *Debaromyces sp.*) exhibited same R_f values. Whereas, the compound No. 4 produced by inoculation with *Debaromyces sp.*, showed R_f 0.92 (Table-1).

Table-1: Retention factor (Rf) of the new Compounds formed from Curcumin treated with different fungi.

#	Compound/ Converted	Microbial cultures	Rf (cm)
1	Curcumin (Parent compound)	-	0.85
2	Derived metabolite - 1	<i>Schizophyllum sp.</i> , <i>Debaromyces sp.</i>	0.52
3	Derived metabolite - 2	<i>Schizophyllum sp.</i> , <i>Debaromyces sp.</i>	0.70
4	Derived metabolite - 3	<i>Schizophyllum sp.</i> , <i>Debaromyces sp.</i>	0.85
5	Derived metabolite - 4	<i>Debaromyces sp.</i>	0.92

**Fig.1.** Derived metabolites identified through Thin Layer Chromatography (PC- Parent Compound, CR- Curcumin, CC- Converted Compound, Schi- *Schizophyllum sp.*, Deb- *Debaromyces sp.*, M- Metabolites)***In vitro* activity of converted metabolites**

Activity of the metabolites measured in terms of diameter of the growth inhibition zone around the discs ranged from 7.66 to 23.33mm, maximum antibacterial activity being in metabolite No.1 converted by the fungi *Schizophyllum* against *Staphylococcus* (Table-2) against control (12.33mm). Activity of the converted compounds enhanced than the parent compound

Table 2: *In vitro* antimicrobial activity of converted metabolites against Flacherie pathogens

Compounds	<i>Staphylococcus sp.</i>		<i>Streptococcus sp.</i>		<i>Bacillus sp.</i>	
	0.5 %	1.0 %	0.5 %	1.0 %	0.5 %	1.0 %
	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD	Mean $\pm$ SD
Met.1	21.67 $\pm$ 0.58 ^a	23.33 $\pm$ 1.15 ^a	19.33 $\pm$ 0.57 ^a	21.16 $\pm$ 0.28 ^a	11.0 $\pm$ 1.73 ^{ab}	12.33 $\pm$ 0.58 ^a
Met.2	17.67 $\pm$ 1.53 ^b	19.33 $\pm$ 1.15 ^b	15.00 $\pm$ 1.00 ^b	15.66 $\pm$ 0.57 ^{ab}	12.66 $\pm$ 2.08 ^a	13.33 $\pm$ 1.52 ^a
Met.3	10.67 $\pm$ 1.15 ^c	10.67 $\pm$ 1.15 ^c	7.66 $\pm$ 0.57 ^c	8.66 $\pm$ 0.57 ^{bc}	11.00 $\pm$ 1.00 ^{ab}	12.33 $\pm$ 1.53 ^a
Met.4	12.67 $\pm$ 2.52 ^c	12.67 $\pm$ 2.52 ^c	0 $\pm$ 0 ^d	0 $\pm$ 0 ^c	10.66 $\pm$ 1.15 ^{ab}	13.00 $\pm$ 1.00 ^a
CR (Control)	11.33 $\pm$ 0.58 ^c	12.33 $\pm$ 0.58 ^c	7.33 $\pm$ 1.52 ^c	8.00 $\pm$ 1.00 ^{bc}	9.66 $\pm$ 0.58 ^b	10.00 $\pm$ 0.00 ^b

Met- Metabolite, CR- Curcumin, 0.5% and 1.0% are compound concentrations, Values represented as Mean $\pm$ SD of Zone of inhibition (mm). *abcd* - superscripts are multiple comparison analysed through DMRT. Significance at $P < 0.05$

2. APS-05001EF (DBT Project): Development of technology for enhancing egg laying in Vanya silk moths by application of Host Plant Volatiles (Apr. 2018 - Sept. 2021) Collaboration with CMERTI, Lahdoigarh and IIHR, Bengaluru

**Dr. K. M. Vijaya Kumari, Dr. Kamala Jayanthi*,
Dr. Karthik Neog**, Dr. D. K. Gogoi** and Mr. R. Gokulraj**
(* IIHR, Bangalore ** CMERTI, Lahdoigarh)

Vanya Silk moth (Eri and Muga silkworm) lays 150-300 eggs depending upon the breed and environmental conditions. Majority of the moths do not lay eggs completely and retain some eggs in the ovarioles of the body. In view of the above, to enable release of eggs completely from the ovarioles and to increase the number of eggs laid by the moths, the present project was initiated. Host plant volatile blends utilized for increasing the fecundity.

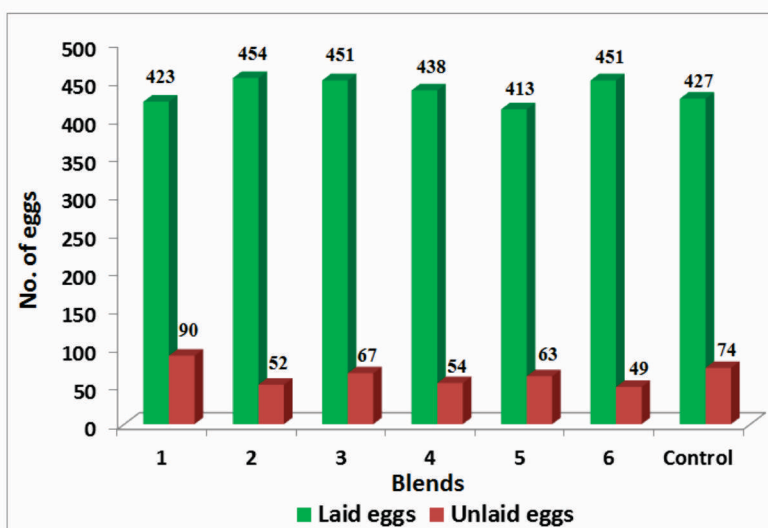
Objectives

1. To evaluate the volatile blends for enhancing the egg production
2. To standardize the synthetic oviposition stimulant blends for Vanya silk moths to enhance egg production
3. Bio-assay studies to confirm the enhancement of egg production in Muga and Eri silkworms

Host plant volatiles evaluation for Eri and Muga silk moths

Chemicals evaluated from the host plant volatiles were tested and the promising ones were used for preparing blends. The blends were test verified for egg laying and egg retention in Eri and Muga silk moths.

Eri silkworm: A total of 14 blends were prepared and tested for egg laying enhancement. Egg laying ranged from 237 to 428 with 35 to 127 retained eggs when compared to control (376 & 68, respectively). In the second trial, from the 14 blends screened, 6 blends were shortlisted based on egg laying and retention (**Fig.1**). In 3rd trial, 3 promising synthetic blends showing maximum values were selected and evaluated by keeping 4.50 kg of seed cocoons for each treatment and control. All the three blends were sprayed separately on the cloth and allowed the moths on that to lay eggs. Recovery of eggs (by wt.) in different blends was 71.78g (Blend-1), 68.20g (Blend-2) and 74.46g (Blend-3) against 64.48g in Control (Table 1). Maximum improvement of 10.12g by weight (15.9%) per kg of cocoons was recorded in Blend-3, when compared to the control.

Fig. 1: Evaluation of Eri blends for egg laying and egg retention**Eri egg laying on the cloth****Table-1: Effect of Synthetic oviposition stimulant blends on Eri grainage parameters**

Blends	Cocoon wt. (kg)	Cocoons / kg	Pairs (%)	Total wt. of eggs (g)	Wt. of eggs g / kg	Dfls/ kg (no)	Improve-ment by wt. (g)	Improve-ment (%)
Blend 1	4.500	384	28.8	323.05	71.78	119	7.30	11.21
Blend 2	4.500	373	29.9	306.90	68.20	113	3.72	5.60
Blend 3	4.500	390	28.9	335.07	74.46	124	10.12	15.90
Control	4.500	378	26.6	290.18	64.48	107	-	-

Muga Silkworm: A trial was conducted with 14 blends for evaluation of egg laying and egg retention in Muga silk moths. All the tested blends showed significantly higher egg laying than the control (Table 2). Egg laying in number ranged from 89.90 to 124.60 in different blends with egg retention of 50.62 to 79.50 when compared to 73.30 and 102.40, respectively recorded in control. Among the blends, significantly highest egg laying was recorded in B8 (124.6) followed by in B5 (122.9) and B13 (120.6).

Table-2: Effect of different blends on egg laying and retention in Muga silkworm

Blends	Eggs laid (No.)	Eggs retained (No.)	Total eggs (No.)
B1	89.90	79.50	169.40
B2	98.40	58.20	156.60
B3	91.45	71.75	163.20
B4	104.60	73.90	178.50
B5	122.90	58.25	181.20
B6	101.75	72.35	174.10
B7	104.30	72.80	177.10
B8	124.60	71.20	195.80
B9	100.65	72.45	173.10
B10	115.85	68.80	184.70
B11	99.60	53.50	153.10
B12	118.05	50.60	168.70
B13	120.65	52.90	173.60
B14	105.30	58.90	164.20
Control	73.30	102.40	186.20
p value	0.02	0.05	0.05

3. AIT06006 MI: Marker assisted screening to identify Silkworm genetic resources tolerant to BmNPV and BmBDV

(Nov 2020- Oct 2023) - *Collaboration with CSGRC, Hosur*

Dr. Ritwika sur Chaudhuri*, Dr. G. Punithavathy*, Dr. G. Lokesh*, Dr. G. Ravikumar* and Dr. R. Saravanakumar** (*CSGRC, Hosur and **SSTL)

The project was taken up to screen the silkworm germplasm stock for presence of BmNPV and BmBDV tolerance genes using molecular markers and to validate the identified stocks through bioassay. The study was aimed at identifying silkworm germplasm breeds with better disease resistance that can be utilized to develop improved silkworm hybrids.

Objectives:

1. To identify silkworm resources tolerant to BmNPV and BmBDV using molecular markers.
2. To quantify the level of resistance/tolerance among selected tolerant genotypes.
3. To validate disease tolerance of the accessions through bio-assay studies.

During period under report, SSTL, Kodathi prepared virus inoculum for conducting bioassay studies by screening of tolerant silkworm races against NPV and BDV. Haemolymph was collected from infected larvae and presence of virus was confirmed through PCR. Project work commenced and work is under progress.

PART II: CONCLUDED RESEARCH PROJECT

1. APR-3635: Development of Seed cocoon and Seed Preservation Technology for Tropical Tasar Silkworm (*Antheraea mylitta* D)

(Mar.2018 - Feb.2021) - *Collaboration with BTSSO, Bilaspur*

Dr. Sailaja B., Dr. G.V. Vishaka*, Dr. P. Sudhakara Rao and Ms. Kamartaj
(*BTSSO, Bilaspur)

Tropical Tasar silkworm, *Antheraea mylitta* D is wild in nature and undergoes pupal diapause. Diapause regulation and emergence patterns are greatly influenced by abiotic factors and influence the seed production process. Processing of seed cocoons for production and supply of quality seeds in desired quantity is one of the most challenging tasks of Tasar silk industry. The study was conducted with the objective to regulate and synchronize the moth emergence through appropriate seed cocoon preservation technologies like photoperiod, temperature and humidity.

Objective 1: Regulation and synchronization of the moth emergence through appropriate seed cocoon preservation at altered temperatures and photo period.

1.1 Regulation and synchronization of the moth emergence through appropriate seed cocoon preservation at various temperature and humidity.

Seed cocoons of different Tasar ecoraces, viz., Daba TV, and BV received during the month of February were preserved at room temperature (25°C; 60±5% RH) till April end. During the month of May (one month prior to normal emergence), these cocoons were consigned at separately different temperatures viz., 7.5°, 10°, 15° and 20° C in equal quantity by maintaining 80% RH. Control maintained separately at room temperature (25°C; 60±5% RH) till moth emergence. During first week of June, preserved cocoons were released from specific temperatures to normal room temperature (25± 2° C) to study the emergence pattern till completion of grainage operation with the idea of shifting / altering the moth emergence rhythm.

Impact of temperature and humidity during cocoon preservation studies revealed that for DTV cocoons, maximum moth emergence (96% of within 18 days) was observed in seed cocoons preserved at 7.5°C and 80% RH against the control (25°C; 60±5% RH) exhibiting 95% of moth emergence in 49 days (Table 1). Moth emergence *vis-a-vis* duration of complete emergence under different temperatures indicated significantly maximum emergence (96%) within 18 days in lots preserved at 7.5°C followed by 84% in 30 days when preserved at 10°C, 76% in 36 days of preservation at 15°C and 96% in 25 days in lots preserved at 20°C as against 95% emergence in 49 days in control batch.

Table-1: MOTH EMERGENCE PATTERN IN PRESERVED (kept one month prior to the natural emergence) TASAR COCOONS AT DIFFERENT TEMPERATURES [Significance at P<0.05]				
Temp (°C)	RACES			
	DTV		DBV	
	Mean ± SD	p value (t stat)	Mean ± SD	p value (t-stat)
7.5	96 ± 2.054	0.702	92 ± 2.054	0.006
10	84 ± 0.577	0.000	88 ± 2.00	0.011
15	76 ± 1.527	0.000	88 ± 2.000	0.113
20	96 ± 0.577	0.004	84 ± 1.527	0.000
Control (Room)	95 ± 0.816	-	80 ± 0.816	-

In case of DBV Cocoons, similar trend of moth emergence was observed in different treatments (92% in 31 days at 7.5°C, 88% in 36 days at 10°C, 88% in 35 days at 15°C and 84% in 36 days at 20°C) against the control (80% in 40 days). Emergence pattern in cocoons preserved at different temperature & RH regimes are given in Table 1. At 7.5°C and 20°C preserved DTV cocoons completed moth emergence within 18 and 25 days, respectively against control (49 days) [Table 1&2].

Table-2: TASAR SEED COCOON PRESERVATION (DAYS / MOTH EMERGENCE %)					
RACE	Control (Temp. 25°C & RH 60 ± 5%)	7.5° C	10° C	15° C	20° C
DTV	49/95	18/96	30/84	36/76	25/96
DBV	40/80	31/92	36/88	35/88	36/84

1.2 Regulation and synchronization of moth emergence through appropriate seed cocoon preservation by altering Photoperiod

Seed cocoons of different eco-races (Daba TV and BV) were preserved at room temperature (25°C; 65±5% RH) from February to April and then exposed to the light regime of 16h Light (4PM – 8 AM) and 8h Dark (8AM – 4 PM) during May (one month prior to the normal emergence) and maintained said photoperiod till completion of grainage operation with the idea of shifting / altering the moth emergence rhythm.

Table-3: Effect of light regime on moth emergence in Tasar cocoons by exposing to 16h L: 8h D.			
RACE	PHOTOPERIOD (16h L:8h D)	CONTROL	p value (t-stat)
DTV	99 ± 2.054	95±0.816	0.1998
DBV	77 ± 0.816	80 ±0.816	0.0213
Significance at P<0.05			

Under 16h Light and 8h Dark condition, in Daba TV, moth emergence was completed within 22 days against control (49 days). But in case of DBV, emergence completed within 29 days against 40 days, respectively in control. With these results, it is evident that photoperiod plays prominent role in shifting of moth emergence rhythm advance, in case of DTV and DBV (Table 3 & 4).

Table-4: TASAR SEED COCOON PRESERVATION (Days / moth emergence %)		
Race	Ctrl (Room Temp.25°C)	16 h Light : 8 h Dark
DTV	49/95	22/97
DBV	40/80	29/88

Standardization of Preservation schedule for mixed age eggs

60-72h aged Tasar eggs collected and preserved at 15°C by maintaining continuous 80-85% RH for 15 days in dark condition. These eggs were released from Cold storage after preservation duration of 15 days to the incubation room, where 25°C of temperature and 80-85% RH were maintained continuously. After 2-3 days of post preservation/ progressive incubation duration, eggs started hatching. 85% hatching of DTV recorded against 87% in control, In case of DBV 80 % was recorded against control (83 %) [Table 5].

Table-5: Hatching Performance of Mixed Age Eggs			
Races	15 days Preservation (15°C & 80-85% RH)	Control (~25°C & ~80% RH)	p value (t stat)
DTV	85±1.247 (@ 19 days)	87± 2.449 (@ 7-10 days)	0.454
DBV	80±1.632 (@ 18 days)	83±3.681 (@ 7-10 days)	0.323
<i>15 days preservation & 2-3 days normal Incubation for treatment</i>			

Conclusion:

As per preservation schedule, Tasar eggs (Daba BV and TV eggs) can be preserved at 15°C temperature with 80-85% RH in dark condition for 15 days along with post preservation / progressive incubation period of 2/3 days and these eggs hatching can be delayed 17/18 days.

Developed short term Tasar egg preservation technology helps to postpone hatching upto total 17 / 18 days during emergency / harsh climatic conditions. This technology can be utilized to preserve the erratically emerged tasar moths laid eggs which can be brushed along with the eggs laid by moths during normal grainage operations. In this way, wastage of eggs laid by erratically emerged moths can be minimized.

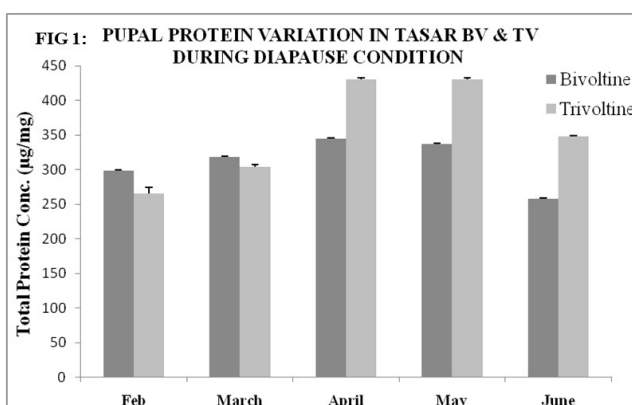
Objective 2: To study Bio-chemical changes during seed cocoon preservation

Present study provides information pertaining to the biochemical processes involved in the two eco-races (DTV and DBV) during pupal diapause. Analysis of different biochemical parameters (Total protein, Carbohydrate and Lipid) in the fat bodies collected from the pupa (irrespective of sex) from the beginning of pupal diapause stage (February) till the moth emergence (June) was done. Analysis was done periodically (interval of 25 days) following standard methods (Lowry's method for Total protein, Anthrone method for Carbohydrate and Bligh and dyers method for Lipid). Biochemical data helps in understanding pupal-adult transformation and also support to work on altering pupal stage progressive developmental duration for commercial exploitation, in future.

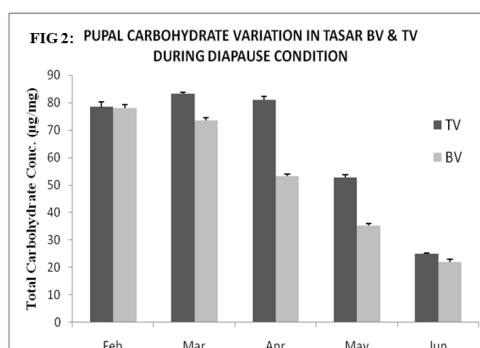
2.1. Total Proteins: The total protein concentration in pupal tissue of BV and TV showed a common trend (Fig 1 & Table 3). It increased from the beginning of the month of February (diapause initiation) to April and then declined till June (diapause termination).

Table-3: Estimation of Total Protein Content of Pupal Tissue ($\mu\text{g} / \text{mg}$ wet wt.) in Tasar, *A. mylitta* D. during development/diapause

Particulars	Total Protein Content of Pupal Tissue ($\mu\text{g}/\text{mg}$ wet wt.)				
	February	March	April	May	June
Trivoltine	266.2	303.7	430.0	431.0	347.8
Bivoltine	298.2	318.5	344.8	337.3	257.8
p value (t - stat)	0.005	0.008	0.001	0.006	0.001



2.2. Total Carbohydrates: In Trivoltine, the total carbohydrate content was observed to be $78.40 \mu\text{g} / \text{mg}$ wet weight tissue during February and gradually increased to $83.3 \mu\text{g} / \text{mg}$ upto March and then slowly declined to $24.9 \mu\text{g} / \text{mg}$ during June. In Bivoltine, the total carbohydrate content was observed to be $77.93 \mu\text{g} / \text{mg}$ wet weight tissue during February and gradually decreased to $21.97 \mu\text{g} / \text{mg}$ during June. Details are given in Fig 2 and Table 4.



The total carbohydrates in the pupal tissue during early pupal stage showed an increasing trend and in late pupal tissue, from the month of March onwards, showed a decline trend in all the two ecoraces as they approached emergence. The stored carbohydrates might have been utilized to generate energy for the preparation of moth emergence and also for formation of gametes in reproductive organs due to this declined trend was noticed in later pupal stage.

Table-4: Estimation of Total Carbohydrate Content of Pupal Tissue (μg / mg wet wt.) in <i>A. mylitta</i> D. during development/diapause					
Particulars	Total Carbohydrate Content of Pupal Tissue ($\mu\text{g}/\text{mg}$ wet wt.)				
	Feb	March	April	May	June
Trivoltine	78.40	83.3	81.0	52.7	24.9
Bivoltine	77.93	73.55	53.18	35.16	21.97
p value (t - stat)	0.001	0.004	0.003	0.005	0.003
Significance at $P < 0.05$					

1.3. Total Lipids: The total lipid concentration in TV and BV pupal tissue of showed an increasing trend from February to March and then drastically declined in the month of June during moth emergence (Table 5).

Table-5: Total Lipid content in Pupal Tissue (g) during development/diapause					
Particulars	Total Lipid Content of Pupal Tissue (g)				
	Feb	March	April	May	June
Trivoltine	0.024	0.040	0.030	0.020	0.017
Bivoltine	0.022	0.030	0.019	0.014	0.010
p value (t-stat)	0.002	0.003	0.009	0.005	0.006
Significance at $P < 0.05$					

Objective 3: To establish embryonic chart for Tasar silkworm.

3.1. Identification of day-wise embryonic developmental phases in Tasar silkworm, through embryo isolation studies

Through embryo isolation methods, day-wise embryonic phases of Tasar silkworm, *Antheraea mylitta* (Drury) eggs were isolated. The embryonic pictures were captured in the form of photographs and arranged chronologically with the identification features (Fig 3).

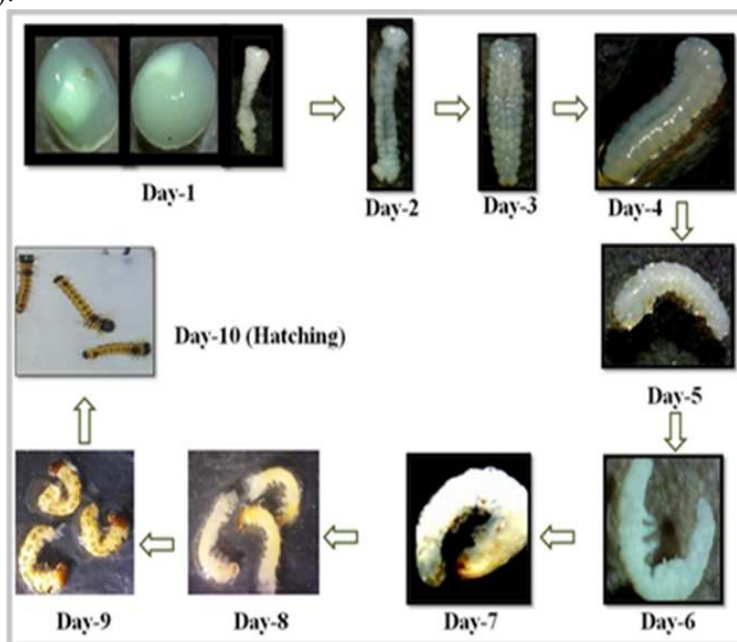


Fig-3: Day-wise embryonic developmental phases in Tasar silkworm

Age of the egg	Observations / Identification features
Day-1	Spoon shaped embryo
Day-2	Increased embryonic length and appearance of neural groove.
Day-3	Decreased length of the embryo, appearance of thoracic and abdominal rudiment appendages.
Day-4	Embryo found in the process of Blastokinesis
Day-5	“C” shaped embryo appeared on the surface of the yolk.
Day-6	Thoracic legs become segmented and rudiments of setae developed.
Day-7	Pigmentation initiated at cephalic region.
Day-8	Head pigmentation and progressive sclerotisation noticed.
Day-9	Complete body pigmentation observed.
Day-10	Larva ready to hatch through the anterior part of the egg shell. Larva hatches out after 240h of oviposition.

Embryonic developmental studies also help in solving practical problems related to identification of suitable embryonic ages [60-72h] for egg preservation at right time and appropriate temperature to overcome the cold storage effect and to manipulate / postpone the hatching date as per field requirement.

On Station Trial (OST)

1. APS 3581 - Development of technology for enhancing egg laying in *Bombyx mori* L. By application of Mulberry volatiles Dr. K. M. Vijaya Kumai and B. V. Raviprasad

The egg recovery enhancement technology developed for Bivoltine hybrid (FC1xFC2) by application of oviposition stimulant blend was test verified in large scale at commercial Silkworm Seed Production Centres of NSSO *i.e.*, Hosur (Tamil Nadu), Vijayapura and Bangalore (Karnataka) under OST program.

After processing, desired combination FC1 x FC2 was studied for moth emergence and pairing. Loose egg gum sheets were made ready by spraying stimulant blend (30 ml/kg) on sheets and allowed depaired female moths for egg laying. Similarly, control batch (without blend spray on gum sheet) were processed in separate room. The study was conducted using 25 kg of seed cocoons in each batch, with three replications. The results on performance of the blend at different grainages and consolidated data are given in Table 1. At SSPC, Bangalore egg yield obtained per kg of cocoons (FC1xFC2) is 96.56g (Treatment) in comparison to control 87g and there was an improvement over control by 9.56g (10.98%). At SSPC, Hosur recorded 97.6g in treatment and 82.08g in control and observed an improvement of 14.8g (18%) over control. In case of SSPC, Vijayapura egg yield obtained per kg of cocoons is 97g in treatment and 87.84g in control and overall improvement of 10.42% was recorded. The average egg yield of 97.05g (Treatment) and 85.64g (Control) per kg of cocoons was recorded (Table 1). The improvement of eggs recovered by weight was 11.41g and 31 dfls (by no.) per kg of cocoons. On an average, the overall egg yield improved by 13%

Table-1: Large scale evaluation of the Bivoltine Synthetic blend in FC1 x FC2 hybrids at commercial Silkworm Seed Production Centres

Treatment	Quantity of cocoons (kg)	No. of cocoons /kg	No. of good cocoons / kg	Total Weight of eggs (kg)	No. of Dfl's	Weight of eggs (g) / kg cocoons	No. of. Dfls / kg cocoons
Blend	25.00	672.33 ±26.18	658.67 ±32.85	2.43 ±0.01	6739.33 ±20.85	97.05 ±0.30	269.33 ±0.88
Control	25.00	672.33 ±26.18	658.67 ±32.85	2.14 ±0.05	5947.33 ±124.79	85.64 ±1.80	237.67 ±4.91
P value (Significance at P<0.05)		NS	NS	0.01	0.02	0.02	0.0001

The average Cost: Benefit ratio calculated for blend was **1:1.74** when compare to control (**1:1.57**) and thus by using this oviposition stimulant blend, the grainuers will be benefitted.

PART III: PROGRAMMES OF THE INSTITUTE

1. GENERATION OF TRAINED MANPOWER IN SEED PRODUCTION TECHNOLOGIES [UNDER CBT/HRD PROGRAM]

**Dr. K. M. Vijaya Kumari, Dr. Veeranna Gowda, Dr. Chandrashekhar R Hegde,
Dr. Sailaja B, Dr. R. Saravana Kumar and R. Rajasekar**

Six training programmes were organised for the stakeholders under CBT on different aspects of seed technology, covering 59 stakeholders (Table 1). Two training programmes under Central Seed Act were conducted on different activities of grainages to the RSPs recommended by NSSO, Bangalore for issuing of certificate to initiate a new private grainage.

Table 1: Details of Training programmes conducted under CBT and Central Seed Act

#	Name of the training	Period	Total Number of Trainees				
			KAR	TN	AP	TOTAL	
Capsule / regular training programmes (approved by CBT of CSB)							
1	Quality Silkworm Seed Cocoon Production – Planning and Management	18-19.11.2020	6	-	-	6	
2	Pebrine detection in Silkworm (I Batch)	27-28.11.2020	6	-		6	
3	Artificial hatching methods for Bivoltine silkworm eggs	05-6.01.2021	10	-		10	
4	Pebrine detection in Silkworm (II Batch)	28-29.01.2021	13	-	-	13	
5	Monitoring of Silkworm Diseases and pests in seed crop	01-02.02.2021	13	-	-	13	
6	Pebrine detection in Silkworm (III Batch)	04-05.02.2021	04	-	-	04	
Sub total			52	-	-	52	
Training programmes conducted under Central Seed Act							
			KAR	TN	AP	MAH	TOTAL
1	I Batch: Silkworm Seed Production Techniques (3 Months)	20.01.2020 to 18.04.2020	2	-	-	1	3
2	II Batch: Silkworm Seed Production Techniques (3 Months)	27.11.2020 to 24.02.2021	4	-	-	-	4
Sub total			6	-	-	1	7
TOTAL							59

2. SILKWORM DISEASE SURVEYS

2.1. Joint Silkworm Disease Monitoring Survey (JSDMS) in Southern India

**Dr.K.M.Vijaya Kumari, Dr. Veeranna Gowda, Dr. Chandrashekhar R Hegde,
Dr. Sailaja B, Dr. R. Saravana Kumar, R. Rajasekar, B S. Muralidhara and
B.V. Ravi Prasad.**

SSTL Scientists visited seed areas (Karnataka-Kunigal / Magadi, Anekal and Attibele; Andhra Pradesh - Madanapalli / Hindupur; Tamil Nadu - Hosur / Denkanikottai) in three Southern States in different seasons and tested Larval/ Pupal / and mother moths samples (Table 2).

Table 2: Joint Silkworm Disease Monitoring Survey (JSDMS) in three Southern States					
#	Place	Date of visit	Lots / Samples		Remarks
			BV	MV	
ANDHRA PRADESH					
1.	Madanapalle seed area	24.02.2021	10/20	1/2	No Pebrine Incidence
2.	Madakasira/ Hindupur	10.11.2020	18/36	2/4	
		23.02.2021	12/24	1/2	
Total			40/80	4/8	
KARNATAKA					
1.	Kunigal / Magadi Multivoltine Seed area	18/19.06.2020	-	295/352	No Pebrine Incidence
		04/05.11.2020	-	364/525	
2.	Anekal/ Attibele Bivoltine seed area	23.06.2020	41/41	-	
		03.11.2020	36/108	-	
Total			77/149	659/877	
TAMIL NADU					
1.	Hosur / Denkanikottai seed area	26/27.06.20	24/24	8/16	No Pebrine Incidence
		06/07.11.20	20/40	10/20	
		15/16.02.20	24/48	6/6	
Total			68/112	24/42	
Grand Total			185/341	687/927	

2.2. SILKWORM DISEASE MONITORING SURVEYS OF SEED AND COMMERCIAL CROPREARINGS OF SOUTH INDIAN STATES - Collaboration with CSR&TI, Mysuru, CSGRC, Hosur and NSSO, Bangalore

Dr. K. M. Vijaya Kumari and Dr. Veeranna Gowda

A total of 03 disease monitoring surveys (Table 2.1) were conducted in seed crops at P3 BSF, Avalapalli and Berigai. Two visits were also made under disease monitoring survey programme in CSGRC, Hosur and P3 BSF, Mysuru.

Table 2.1: Joint Silkworm Disease Monitoring Survey (JSDMS) in three Southern States					
Collaborative programmes with CSR&TI,Mysuru					
#	Place	Date of visit	Testing stage	Lots / Samples	Remarks
1.	P3 BSF, Avalapalli	13.07.2020	V Instar 4 th & 5 th day	4/4	No Pebrine Incidence
2.	P3 BSF, Berigai	12.11.2020 15.02.2021	V Instar 4 th day	4/6	
Total				8/10	
Collaborative programmes with CSGRC and NSSO					
#	Place	Date of visit	Testing stage	Lots / Samples	Remarks
1.	P2 BSF, Mysore	16.09.2020 17.03.2021	Mother moth (BV)	2/582	3.85% Pebrine Incidence
2.	CSGRC, Hosur	06.08.2020 09.03.2021	Egg shell / Mother moth (Both BV & MV)	386/2427	No Pebrine Incidence
Total				388/3009	

3. EXTENSION ACTIVITIES

3.1 Transfer of Technology programmes (ToT):

During the period under report, 01 Awareness (G. Agraharam village, Krishnagiri, Tamil Nadu) and 05 Technology Demonstration programs for the benefit of staff of Sericulture Department of the southern States were conducted. A total of 115 persons were sensitized (Table 3).

Table 3: Details of Extension Communication Programmes

Programmes	No. of events	Persons sensitized
Technologies Demonstrations		
1.Disease management and disinfection methods	1	13
2.Demonstration on Hibernation schedules	1	13
3.Mother moth examination for pebrine detection	1	16
4.Embryo isolation techniques	1	10
5.Demonstration on disinfection and hygiene	1	10
Total	5	62
Awareness programme		
1. Silkworm diseases and management	1	53
Grand Total	6	115

4. MAINTENANCE AND MULTIPLICATION OF PURE BREEDS

Dr. Veeranna Gowda and S. Muralidhara

Under the programme, a total of 10 Multivoltine silkworm breeds viz., Nistari, M12W, M6DPC, Sarupat, L14, APDR15, MCon1, MCon4, MH1 and Pure Mysore were maintained and 04 rearings & seed production cycles were carried out following standard procedures of silkworm germplasm stock maintenance.

a) Rearing Performance:

Four rearings were conducted and racial traits like larval growth, markings, colour, spinning behaviour of all the breeds were recorded. All the breeds performed as per breed characters (Table 4).

Table 4: Rearing performance of Multivoltine pure breeds (Mean of 4 crops)

Race / Breed	Fecundity (No.)	ERR/10,000		Cocoon Wt. (g)	Shell Wt. (g)	SR (%)	Pupation rate (%)	Larval period (days)
		Wt.(Kg)	No.					
Nistari	435	8.600	8,810	1.010	0.150	14.85	93.95	22.50
M12W	424	8.100	9,150	1.050	0.140	13.33	94.10	23.25
M6DPC	433	8.250	9,250	1.180	0.180	15.25	91.50	23.50
Sarupat	431	8.550	8,750	1.020	0.138	13.53	92.25	23.18
L14	463	10.750	9,400	1.208	0.210	17.50	94.60	24.12
APDR15	432	10.550	9,150	1.200	0.201	17.38	92.50	23.16
MCon1	418	10.500	9,150	1.190	0.180	15.13	93.60	23.24
MCon4	424	9.850	9,170	1.155	0.175	15.15	94.25	23.18
MH1	431	10.550	9,150	1.150	0.175	15.22	94.50	23.5
PM	451	8.150	8,850	1.080	0.162	15.00	94.30	26.25

b) Grainage Performance:

Seed cocoons of all the 10 multivoltine pure breeds generated were processed for production of disease free layings by following standard protocol (Table 5). On an average, the pairs percentage ranged from 40.00 to 42.30% and Dfls recovery varied from 35.65% to 38.63%. Among the 10 Multivoltine breeds studied, L14 has recorded highest pairs (42.30%) and 38.63% Dfls recovery followed by MH1 breed with 41.60% pairs and 38.18% Dfls.

Table 5: Grainage performance of Multivoltine breeds (Mean of 4 crops)			
#	Race / Breed	Pairs (%)	Dfls (%)
1	Nistari	40.40	36.67
2	M12W	41.00	37.33
3	M6DPC	40.00	36.70
4	Sarupat	41.20	36.25
5	L14	42.30	38.63
6	APDR15	41.50	36.67
7	MCon1	40.50	36.07
8	MCon4	40.60	38.16
9	MH1	41.60	38.18
10	PM	40.10	35.65

5. TESTING OF SAMPLES

5.1. Testing of chemicals/silkworm samples

Dr. R. Saravanakumar, Ms. K.R. Rathnamma

Silkworm Seed Pathology Laboratory is accredited under Central Seed Act to do quarantine testing and issuing of quarantine certificate for exporting silkworm eggs to other countries. It also undertakes testing of disinfectant samples and silkworm, egg shell samples sent by the stake holders. Following works were taken up:

- **Quality testing of disinfectants:** 6 samples of Decol received from M/s. Kamath Chlorotech, 02 samples from M/s. Durga biotech and five samples from DoS Karnataka were tested for quality standards.
- **Egg shell testing:** 12 samples of egg shells from P2 BSF, Yelagiri Hills were tested for pebrine disease freeness.
- **Larval testing:** 48 larval samples received from different farmers were tested for disease incidence.

Quarantine seed testing: Bivoltine Double hybrid seed received in 40 boxes from NSSO, Bangalore were tested and issued quarantine certificate as per provisions of Central Silkworm Seed Act for export to Kampala, Uganda.

5.2. Testing of Silkworm eggs

Dr. Sailaja Bandam and Dr. K. M. Vijaya Kumari

12 and 05 lots of silkworm BV eggs received from SSPC, Bengaluru and Cold storage, Hosur, respectively for checking healthiness of eggs and also for identification of embryonic growth stages. This was to facilitate seed preservation.

PART IV: GENERAL / OTHER ACTIVITIES

1. Farm Management

Dr. K. M. Vijaya Kumari, V. Chandrasekhar Reddy and S. Nataraj

Mulberry plantation (varieties V1 and G4) was maintained for experimental rearing purpose. During the year, additional 0.6 acre of G4 Mulberry Variety (355 plants) was also planted



Under revenue generation programme, three batches of seed crops of bivoltine FC1 and FC2 were reared. The Seed cocoons of Crop No. 01 were supplied to SSPC, NSSO, Hosur and the cocoons of other two crops were stifled and marketed. The amount generated was accounted under Revenue.

Rearing Performance of Bivoltine Seed Crops							
Crop No.	Race / FC	No. of Dfls	Crop yield		SCW (g)	SSW (g)	SR (%)
			by No.	Wt. (Kg)			
1	FC1	50	21,020	34.055	1.982	0.492	24.82
	FC2	50	22,724	38.050	1.898	0.438	23.08
2	FC1	20	9,275	13.250	1.580	0.362	22.91
	FC2	20	9,736	14.050	1.570	0.349	22.23
3	FC1	40	11,225	15.850	1.650	0.370	22.42
	FC2	40	11,900	16.550	1.620	0.360	22.22

3. Tree Plantation

As a part of conservation of soil in the vacant area, tree plantation in about 12 ha. area was taken up with the co-operation of Forest department. Economically important trees like, Jamun, Jack fruit, Pongamia, Shivane, Beete mara, Tore matti, Kadu badami, etc., (Total 1,728 tree saplings) were planted.



4. राजभाषा कार्यान्वयन/ Official Language Implementation

डॉ. वीरण्णा गौड़ा और श्री. आर. राजशेखर

संस्थान ने अपने प्रयासों के माध्यम से भारत सरकार, गृह मंत्रालय, राजभाषा विभाग द्वारा जारी वार्षिक कार्यक्रम के अनुसार केंद्र सरकार के कार्यालयों में हिंदी नोटिंग (44.06%) सहित निर्धारित 65% लक्ष्य के तुलना में 76.32% का लक्ष्य प्राप्त किया है। रिपोर्टाधीन वर्ष के दौरान इस संस्थान के अधिकारियों/कर्मचारियों ने हिंदी कार्यशालाओं में भाग लिया। हिन्दी पखवाडा/दिवस दिनांक 01.09.2020 से 14.09.2020 तक रेशमकीट बीज प्रौद्योगिकी प्रयोगशाला द्वारा आयोजित किया गया। वार्षिक कार्यक्रम के एक भाग के रूप में अधिकारियों ने ऑनलाइन हिंदी पत्राचार पाठ्यक्रमों में भाग लिया। उक्त हिंदी पाठ्यक्रमों में डॉ. आर. सरवनकुमार, वैज्ञानिक-सी ने प्रबोध और श्रीमती के आर रत्नम्मा, वरिष्ठ तकनीकी सहायक ने प्रवीण पाठ्यक्रम में सफलतापूर्वक भाग लिया। रेशमकीट बीज प्रौद्योगिकी प्रयोगशाला में क्रमशः 30.06.2020, 29.09.2020, 11.12.2020 और 10.02.2021 को चार राजभाषा कार्यान्वयन समिति के बैठकें आयोजित की गईं। श्रीमती जयश्री, सहायक निदेशक (राजभाषा) और श्री. सुनील कुमार, वरिष्ठ हिंदी अनुवादक रारेबीसं, केंरेबो, बेंगलुरु द्वारा दिनांक 10.02.2021 को राजभाषा कार्यान्वयन कार्यों का निरीक्षण किया गया।

The Institute has achieved 76.32 % of the assigned target of 65% along with notings (44.06%) towards the Hindi correspondences to Central Government offices as per OLIC Annual programmes of Ministry of Home affairs. Hindi workshops were attended by officers/officials of this Institute during the year under report. SSTL organized Hindi Pakhwada / Hindi Diwas from 01.09.2020 to 14.09.2020. As a part of OLIC, the staff attended the Online Hindi correspondence courses. In the said courses, Dr. R. Saravanakumar, Scientist-C attended Prabhodh and Smt. K. R. Rathnamma, Senior Technical Assistant attended Praveen courses successfully. A total of four OLIC meetings were conducted at SSTL on 30.06.2020, 29.09.2020, 11.12.2020 and 10.02.2021, respectively. Inspection of works under Official Language Implementation was conducted by Smt. Jaishree, Assistant Director (OL) and Sri. Sunil Kumar, Senior Hindi Translator, NSSO, CSB, Bengaluru on 10.02.2021.



PART V: PUBLICATIONS

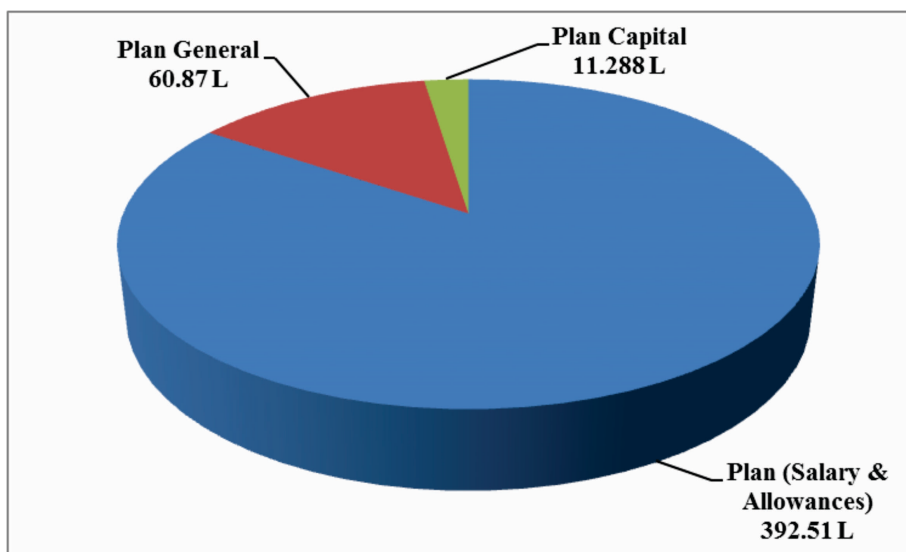
1. Jayappa T, Dutta R N , Sudhakara Rao P, Saravanakumar R, Hanumantharayappa S K and Mishra R K (2020) Fortification of Mulberry leaves with selected Micronutrients and their effect on seed crop rearing of Silkworm (*Bombyx mori* L). *IJRSR*, 11 (12): 261-264.
2. Sudhakara Rao P, Jayappa T, Vijaya Kumari K M, Sailaja B, Saravana Kumar R, Mishra R K (2020) Disinfection and maintenance of hygiene in seed crop rearing. *Indian Silk* 11 (old 59) (2): 8-10.
3. Vijaya Kumari K M, Jayappa T, Sudhakara Rao P, Saravana Kumar R, Ghosh M K, Regina Bhutia and Mishra R K (2020) Seed preservation through double step refrigeration. *Indian Silk*, 11 (old 59) (3): 16-17.
4. Veeranna Gowda (2020) Reshme krushi Udyamadalli Mahilaa Sabhaleekarana. *Reshme vani*, 2(1):2 (Kannada).

PART VI: SEMINARS / TRAININGS / PROGRAMMES

#	Title of Programme	Venue and Date	Persons Participated
1	Contemplate Perspectives on Seed: Conservation, Quality Assurance and Supply systems (webinar)	ICAR, Indian Institute of Seed Science on 10 th September 2020	Dr. Sailaja Bandam
2	Wild Silk moths Diversity and its <i>ex-situ</i> and <i>in-situ</i> conservation in India (webinar)	University of Mysore, Mysore on 10 th September 2020	Dr. Sailaja Bandam
4	Enterprise Opportunities in Mulberry Silkworm Seed Sector (webinar)	University of Mysore, Mysore on 12 th November 2020	Dr. K.M. Vijaya Kumari Dr. Sailaja Bandam Dr. R. Saravana kumar
4	20 th Pebrine meeting (webex)	CSRTI, Mysore on 30 th December 2020.	Dr. K. M. Vijaya Kumari
5	Hindi workshop	RSRS, Kodathi on 16 th December 2020.	SSTL officials / officers
6	Breeding strategies for the development of silkworm breeds tolerant to high temperature and BmNPV	University of Mysore, Mysore on 18 th December 2020	Dr. Sailaja Bandam

PART VII: BUDGET DETAILS

A total amount of Rs. **4, 64, 66, 550/-** was received as Grants-In-Aid (GIA) for the year 2020-21. The details of expenditure made under different heads are given below. A sum of Rs.13, 70, 103/- was generated as revenue for the financial year 2020-21 and remitted to Central Office.



REVENUE GENERATION DURING THE YEAR 2020-2021

#	Particulars	Amount (Rs.)
1	Royalty received for Decol and CRH	11,39,632.00
2	Cold Storage - Egg Preservation charges	27,002.00
3	Income from Hostel rent, Training course fee, etc.	1,54,050.00
4	Others (Testing charges, Sale of books, Cut cocoons, Mulberry leaf and Quarantine Charges)	49,419.00
Total		13,70,103.00