CURRICULUM VITAE
&
SIGNIFICANT CONTRIBUTIONS

Of

Dr. S. NIRMAL KUMAR

M.Sc., Ph.D., FICER

DIRECTOR

Central Sericultural Research & Training Institute,

Central Silk Board [Ministry of Textiles – Govt. of India]

Berhampore – 742101, Murshidabad Dist., West Bengal

PART-I

CURRICULUM VITAE

of

DR. S.NIRMAL KUMAR

(Director, CSRTI, Berhampore)

Curriculum vitae & Significant contributions of
Dr. S. Nirmal Kumar M.Sc., Ph.D, FICER

(As on 31st March 2015)

Director
Central Sericultural Research & Training Institute, Berhampore

Date of birth	29th July 1955
Educational qualification	**M.Sc, (Zoology with Genetics), Ph.D., (Sericulture),** Mysore University Thesis title: "Studies on the synthesis of appropriate silkworm breeds for tropics"
Experience	**37 years in Central Silk Board** (Research & Teaching – 32 yrs and Extension - 5 yrs)

Credentials	International	National
Awards	1	**11**
Honour received	-	**7**
Appreciation certificate	9	**2**
Fellow	**FICER** (Fellow of International Congress of Environmental research)	**-**
Membership	**BACSA** (Black Caspian Seas & Central Asia Silk Association) Bulgaria	**11**
Patents – Granted Published Registered	-	**2** **7** **2**
Research Guide Ph.D.– **Awarded** **Working** **M.Sc. - Dissertation –** **Awarded**	- -	 **4** **1** **19**
Technology Commercialized	-	**3**
Silkworm Hybrids Authorized	**-**	**7**
Recognition Sericulture Expert PG Examiner - **Universities** Editorial Board Member Scientific Referee	 1 - 5 5	 **2** **5** **-** **5**
Books: Written/ Edited/ Compiled Booklets/Pamphlet	-	 **36** **62**
Professional Training	2	**12**
Publications	84	**286**

Fields of Specialization: Sericulture / Genetics / HRD

- ⇨ Genetics & Breeding of Silkworm
- ⇨ Mulberry and Silkworm improvement
- ⇨ Egg production and Silkworm rearing
- ⇨ Human Resource Development in Sericulture
- ⇨ Transfer of Technology (extension) in Sericulture
- ⇨ Seri-biotechnology

Professional Experience and Positions held:

(a) Experience in Research Planning, Guiding, Monitoring & Coordination: >37 years

From 1978 to 1981: Actively involved in Research, Training and Extension activities of non mulberry sericulture. Testing of silkworm races; Food plant cultivation and rearing technologies *etc.*

Since 1981 to 1998 Actively involved in Research, Training and Extension activities of mulberry sericulture. Testing of silkworm breeds; mulberry cultivation and rearing technologies *etc*.

Since 1998: Till date Involved in planning, directing, implementing and monitoring R&D programmes in Sericulture besides co-ordinating HRD activities.

Experience in Teaching & HRD: 32 years

(a) Teaching:	Involved regularly in teaching both, graduate and post-graduate/Ph.D. students in various subjects of sericulture. Acting as paper setter, examiner and referee for M.Sc. & Ph.D. examinations.
(b) Recognition as P.G. Teacher and research guide:	Recognised as Post graduate teacher and Research Guide for Sericulture from Mysore university.
(c) P.G. Teaching/ Supervising:	Ph.D. : 04 (Awarded – 4) M.Sc. : 19 (Awarded – 19)
(e) Member of Board of Studies in Sericulture:	Served as Member, Board of Studies in Mysore university

Awards: 12

a) International: WIPO Award 2005

(World Intellectual Property Organization, Geneva) Certificate of Merit for the invention of "Sampoorna".

b) National:

1. **Star of Asia Award 2014** (New Delhi) for outstanding achivements in the field of Education.
2. **Best Educationist Award 2014** (New Delhi) for outstanding achivements in the field of Education.
3. **Institute Award 2008** (Mysore) for Outstanding Contribution to Sericulture Research.
4. **Technology day Award 2004** (NRDC, India) with individual shield, certificate and Rs. 1 lakh jointly for meritorious invention of "SAMPOORNA".
5. **CSB Team Award 2003** (CSB, Bangalore) for outstanding contribution towards development of Sericulture /industry in field of seed production/ extension services (Popularization of productive double hybrid (CSR6xCSR26) x (CSR2xCSR27) and viable sex limited breed (CSR2SL).
6. **Seth Baladeodas Shah Award 1994-1995** (Kolkata) for the outstanding contribution for the evolution of productive bivoltine hybrids *viz.,* CSR2 x CSR4 and CSR2 x CSR5.
7. **Awarded Best Poster 2011** "Green" silk – Dye chemistry to Dyeability on National Science day at NCL Pune
8. **Awarded First prize for the paper 2011** Akil Bharatiya Rajabhasha Takiniki Seminar, Ranchi.
9. **Best Oral Presentation Award 2000** (Mysore) National Conference on strategies for sericulture research and development.
10. **Best Poster Presentation Award 2000** (Mysore) National Conference on strategies for sericulture research and development.
11. **Best Paper Presentation Award 1992** (Mysore) National Conference on Mulberry Sericulture Research.

Honour received: 07

1. From Karnataka State Sericulture Minister Shri. Revanna "For the invention of the product SAMPOORNA for uniform maturity in silkworm" Krishimela, Mysore, January, 2003.
2. From Karnataka State Sericulture Minister Shri. Revanna "For the evolution of productive bivoltine silkworm hybrids" during Krishimela, Mysore, January, 2003.
3. From Karnataka State Sericulture Minister Shri. Revanna "For the evolution of the productive bivoltine double hybrid (CSR6 x CSR26) x (CSR2 x CSR27)" Krishimela, Mysore, November, 2003.

4. From Dr. G.K. Veeresh, Former Vice Chancellor, UAS Bangalore in presence of Prof. V.L.Chopra, President National Academy of Agricultural Sciences for the "Development of SAMPOORNA" 2004.
5. From Dr.S.B.Dandin, Vice Chancellor, Horticulture University, Bagalkot for the contributions to sericulture, KSSRDI, Bangalore, September 2011.
6. From Dr. Bharathi, Dean, School of sciences, Padmavathi Mahila Viswa Vidalayam, Tirupati for the contributions to sericulture, March 2012.
7. From Dr. A.S. Bhoite Pro Vice Chancellor, Shivaji University, Kolhapur at Pune for the contributions to sericulture, September 2013.

Certificate of appreciation: 11

1. From Takashi Shirai, President, SDS Biotech K.K Japan, 2007- For a commendable job for success of JHA Project in Southern India (2004-2006).
2. From Dr. H. Yanagawa, Chief Advisor, Japan International Co-operation Agency, Japan 2007 – For excellent efforts in the implementation of Bivoltine Sericulture Technology in India (2002-2007).
3. From Dr.Toshio Yamamoto, JICA, Training Expert, Japan -2007 – For Diligence and Impressive activity.
4. From Akio Yamaguchi, Race Maintenance Expert, Japan International Co-operation Agency, Japan 2005 – For being Instrumental in maintaining the original breed characters of CSR breeds (2000 -2005)
5. From Dr.Kawakami,Team Leader, Japan International Co-operation Agency, Japan 2002 – For excellent efforts in the popularization of Bivoltine Sericulture Technology in India (1997- 2002).
6. From Akio Yamaguchi, Race Maintenance Expert, Japan International Co-operation Agency, Japan 2002 – For learning the intricate problems in silkworm breeding and race maintenance (2000 -2002).
7. From Hirako Matsuo, Silkworm Race Maintenance Expert, Japan International Co- operation Agency, Japan 2000 – For learning the intricate problems in silkworm race maintenance, multiplication and Silkworm breeding.
8. From Dr.Toshi Yamamoto, Chief, NISES, Japan 1994 – For commendable analytical ability to interpret the scientific results.
9. From Dr.K.Takamiya, Director, NISES, Matsumoto, Japan 1994 – For high degree of Research endeavors.
10. From Dr.G.L.Shekar, Principal, NIE, Mysore-2011- For active participation in Network and Internet programme.
11. From Dr. S.M.H.Qadri, Director CSRTI, Mysore-2013- For significant contribution in Promoting Bivoltine sericulture under cluster promotion programme during XI plan period in Karnataka.

Outstanding Professional Achievements: 36

1. Awarded Fellow membership of International Congress of Environmental Research (FICER) India – 2010
2. Awarded Member BACSA (Black, Caspian Seas and Central Asia Silk Association) Bulgaria 2010.
3. Member & Joint Secretary for South India – National Academy of Sericulture Science, India (2011 to till date).
4. Member Silk Society of India, Maharastra 2012.
5. Member Indian Animal Ethics Committee (2009 to till date).
6. Chairman, Institute Bio Safety Committee - CSRTI, Berhampore (2013 to till date).
7. Recognized as Sericulture expert in –
   a) Database of life sciences (New Delhi),
   b) BACSA expert Database (Bulgaria),
   c) Database in Sericulture (KSSRDI-Bangalore)
8. Member convener- Research Advisory committee – CSRTI, Berhampore – West Bengal (2013 to till date)
9. Chairman – Research Council - CSRTI, Berhampore – West Bengal (2013 to till date)
10. Vice Chairman – Regional Research Advisory committee – RSRS Kalimpong – West Bengal (2013 to till date)
11. Vice Chairman – Regional Research Advisory committee – RSRS Jorhat – Assam (2013 to till date)
12. Vice Chairman – Regional Research Advisory committee – RSRS Koraput (2013 to till date)
13. Vice Chairman – Regional Research Advisory committee – RSRS Ranchi (2013 to till date)
14. Member – State level co ordination committee for sericulture – West Bengal (2013 to till date)
15. Member – State level co ordination committee for sericulture – Orissa (2013 to till date)
16. Member – State level co ordination committee for sericulture – Bihar (2013 to till date)
17. Chairman – Murishidabad district Hindi official language implementation committee (2013 to till date)
18. Member – All India Sericulture Research co ordination committee (2013 to till date)
19. Member – All India Mulberry evaluation committee (2013 to till date)
20. Member All India Silkworm Hybrid Authorization Committee, CSB Bangalore (2009 to till date).

21. Member – Scientific Advisory committee – National silkworm Seed Organisation, Bangalore (2013 to till date)
22. Member – Research Advisory committee – Seribiotech Research Laboratoty, Bangalore (2014 to till date)
23. Member - Research Advisory committee – central Sericultural Germplasm Resource Centre, Bangalore (2014 to till date)
24. Chief Public information officer for Right to information act (2013 to till date)
25. Member Board of studies in Sericulture, University of Mysore, (2010-2013).
26. Member Board of examiners in Sericulture, University of Mysore, (2009-10)
27. Member Institute Bio Safety Committee - CSRTI, Mysore (2007 to till date)
28. Member Research Council- CSRTI, Mysore (2008 to till date)
29. Member Doctoral committee- CSRTI, Mysore (2008 to till date).
30. Member Revision of sericulture technology books UAS Bangalore (2009-10)
31. Member Core Committee for collaborative projects between UAS Bangalore and CSRTI, Mysore 2011
32. Recognized research guide in sericulture, UOM, Mysore -2002 to till date
33. Appointed as Assistant Public Information Officer for RTI –CSRTI, Mysore (2009 to till date).
34. Invited participation in International meeting - JHA project at Tokyo Japan from 17th to 26th Nov 05.
35. Member – All India Integrated Skill development Programme (2013 to till date)
36. Member – Official Hindi language implementation committee – CSB (2013 to till date)

Patents: 11

a. Granted:

1. A Semi-synthetic diet for rearing young instar tropical tasar silkworm, Antheraea *mylitta.* (Patent no. 240259, dtd. 07/05/2010, Journal no 19/2010).
2. Universal Semi-synthetic diet for young instar silkworm- Multivoltine x Bivoltine hybrids of silkworm *Bombyx mori.* (Patent no.247304, dtd.8.4.2011, Journal no 14/2011)

b. Published:

1. A process for producing different colours of silk by silkworms. (no.246/CHE/2007, 02/02/2007, publication dtd 28/11/ 2008, Journal no. 48/2008)
2. A Semi-synthetic diet for young instar Eri silkworm. (no.2115/CHE/2007, 02/09/2007, publication dtd 11/09/ 2009,Journal no. 37/2009)

3. Process for Preparation of silkworm powder for human health beneficial effects. (no.365/CHE/2008, 13/02/ 2008, publication dtd 11/09/2009,Journal no.7/2009.
4. Process for Preparation of nutritious silkworm pupae for human food. (no.1814/ CHE/2008, 29/07/2008, publication dtd 05/02/2010,Journal no. 6/2010)
5. Process for Preparation of nutritious, odorless pupae powder for different potential application. (No.1813/CHE/2008, 29/07/2008, publication dtd 5/02/2010,Journal no. 6/2010)
6. Process for Preparation of transparent, odorless refined silkworm pupae oil for possible different potential application (no.1764/CHE/2008, 23/07/2008, publication dtd 29/01/2010,Journal no. 5/2010)
7. Process for the extraction of fibroin from *Bombyx mori*. (no.2447/CHE/2009, publication dtd.15/04/11, Journal no.15/2011)

c. Registered:

1. Process for extracting virgin sericin of *Bombyx mori* for potential industrial applications. (no.1831/CHE/2009,03/08 2009)
2. "Muga Nutrid" A semi synthetic diet for young instar Muga silkworm *Anthraea Assamensis* Helfer. (no.2901/30.09.2010)

Ph. D Guideship: 05

1. "Studies on extraction, purification & qualitative variation in fibroin in breeds/ hybrids of silkworm *Bombyx mori* L. for value added product" – Awarded-2009
2. "Evolution of silkworm strains (*Bombyx mori* L.) suitable for rearing on artificial diet"- Awarded-2010
3. "Studies on the evaluation methods designed to utilize heterosis for the improvement of quantitative traits in *Bombyx mori* L."- . Awarded-2010
4. "Studies on the influence of plant based Juvenile hormone mimics on the growth survival and economic characters of the silkworm *Bombyx mori* L. – Awarded-2012
5. "Comparative studies on feeding potential, growth pattern and economic traits in the silkworm *Bombyx mori* L. reared on semi-synthetic diet and mulberry leaf" – Working.

M.Sc. Dissertation: 19

1. Comparative analysis of oil extracted from larvae, pupae and adult silkworm moth of *Bombyx mori* (2013)
2. Quantification of Deoxynojirimycin (DNJ) in mulberry plants and silkworm powder (2013)

3. Use of probiotics to improve economic characters of silkworm *Bombyx mori*. (2012)
4. Studies on comparative biochemical profile of different moths of silkworm *Bombyx mori*. (2012)
5. *In vitro* testing of disinfectants used in sericulture to control the growth of fungi in rearing houses. (2010)
6. *In vitro* testing of disinfectants used in sericulture to control the growth of bacteria in rearing houses. (2010)
7. Culturing some of useful fungi on *Bombyx mori* spent pupae" (2009)
8. Studies on comparative feed conversion efficiency of newly evolved multi x bivoltine hybrid (2009)
9. Studies on reproductive efficiency of bivoltine breeds and foundation crosses of silkworm *Bombyx mori* L. (2009)
10. Biochemical analysis of silkworm larval powder of *Bombyx mori* (2008)
11. Biochemical analysis of pupae and refined pupa oil of silkworm *Bombyx mori* (2008)
12. Protein banding pattern in the de-oiled pupal powder of silkworm *Bombyx mori* L in different sexes.(2007)
13. Isolation and purification of vitamin C from plants.(2007)
14. Effect of Ascorbic acid on the economic characters of silkworm *Bombyx mori* L. (2006)
15. Influence of different treatment regimes of phytoecdysteroid on silkworm *Bombyx mori* L. (2005)
16. Role of temperature in larval maturation of silkworm *Bombyx mori* L on administration of phytoecdysteroid (2004)
17. Studies on the comparative performance of silkworm reared on artificial diet and mulberry leaf (2003)
18. Studies on the effect of phytoecdysteroid on seed crop performance of silkworm *Bombyx mori* L. (2002)
19. Studies on the egg index in CSR bivoltine silkworm strains and their foundation crosses (1996)

Technology Licenced and Commercialised: 03

1. "NUTRID"- A semi synthetic diet for young instar silkworms - Know how fee – Rs. 10 Lakh paid by Sericare Bangalore.
2. "Sampoorna"– A hormone for synchronized maturity and spinning - Know how fee - Rs. 03 Lakh paid by Sericare Bangalore.
3. "Samrudhi" – A hormone for the increase of cocoon/silk yield – Know how fee - Rs 0.25 Lakh paid by Serigro Bangalore.

Sikworm Hybrids Authorised: 07

1. Bivoltine single hybrids	= **05**	CSR2 x CSR4, CSR2 x CSR5, CSR3 x CSR6, CSR12 x CSR6 & CSR2A x CSR4A
2. Bivoltine Double hybrid	= **01**	(CSR6 x CSR26) x (CSR2 x CSR27)
3. Multi x Bivoltine hybrid	= **01**	BL67A x CSR101A

Recognized Postgraduate examiner:

a) Mysore University – Mysore – Karnataka
b) Bangalore University – Bangalore – Karnataka
c) Tamilnadu Agriculture University - Tamil Nadu
d) Periyar University - Tamil Nadu
e) Manonmanian University-Nagercoil - Tamil Nadu
f) Padmavathi Mahila University – Tirupaty – Andra Pradesh

On Editorial board - International Journals:

a) International Journal of Zoological Research
b) Journal of Entomology
c) Research Journal of Environmental Sciences
d) Asian Journal of Scientific Research
e) Asian Journal of Biological Sciences

Breakthrough research:

1) A universal semi synthetic diet for young instar cross breeds
2) A Novel *in vivo* technique for the induction of natural colour to silk
3) Introduction of dominant tri moulter trait in bivoltine silkworms
4) Development of sericin rich hybrid
5) Development of Improved cross breed capable producing gradable silk
6) Introduction of *id* gene in silkworm where in when crossed with bivoltine female results in the progeny laying non diapause eggs

Development of Index:

1. Multiple trait evaluation index for the selection of breeds/hybrids
2. Silkworm growth index as a ready reckoner for young instar silkworms

Professional Training undergone:

a) Overseas:

1. Advanced training in silkworm breeding and genetics at National Institute of Sericulture and Entomological Science, **Matsumoto, Japan** for **one year** under the guidance of Dr. T. Yamamoto with the fellowship of JICA (93-94).
2. Intensive Japanese language course (July 1993) conducted by Tokyo International Co-operation Agency, **Japan**.

b) National:

1. Biological application in Electron Microscopy – conducted by DST, New Delhi, Nov. - Dec, 1995 for 5 weeks.
2. Russian language course (March 1990 to Oct 1990) at CSRTI, Mysore.
3. Specialized training in silkworm breeding conducted by Dr. Y. Mano, JICA Silkworm Breeding Expert at CSR&TI, Mysore, Oct-Dec. 1992.
4. Specialized training in silkworm breeding conducted by Dr. K. Takamiya, JICA Silkworm Breeding Expert at CSR&TI Mysore, July-August. 1995
5. Training on Hindi Noting and Drafting – Two days at CSRTI, Mysore (2002).
6. Live workshop on Rhinoplasty, Plastic surgery dept, Bowring hospital, Bangalore,2006
7. Training in large scale production of diet and diet rearing technology conducted by Dr. Yamaguchi, Silkworm Breeding Expert at CSR&TI Mysore/Bangalore,March 2007.
8. Training in Science and Law for Scientists – One week at ASCI, Hyderabad February 2008.
9. Training on Technology commercialization – Two weeks at ASCI, Hyderabad (2009)
10. Training on Right to information act–Two days conducted by National Productivity Council at Bangalore (2009).
11. Training on Hindi Noting and Drafting – Two days at CSRTI, Mysore (2010).
12. Basics of Network and Internet usage – Two days at NIE, Mysore (2011)

Conferences and Seminars participated:

International – 11
National – 40

Chaired sessions, Delivered key note addresses, Plenary lectures, Presented Base/ Lead papers, *etc.*

Major Research Projects/ programmes implemented as Project Leader/ Project Investigator:

(A) International:

I. "Project for Bivoltine Sericulture Technology Development " JICA Phase I (1991 to 1997)-Project Investigator

II. "Project for promotion and popularization of Bivoltine Sericulture Technologies" funded by Japan International Co-operation Agency (JICA) Phase II (1997-2002) – Project Investigator.

III. "Project for Strengthening Extension System for Bivoltine Sericulture in India" funded by Japan International Co-operation Agency (JICA) Phase III (2002-2007) – Project Investigator.

IV. Popularization of JHA, SB-515 for improvement of cocoon yield in silkworm, *Bombyx Mori* L. in the sericultural states of southern India in collaborative project with "Tokyo University of Agriculture and Technology, Tokyo, Japan" and "SDS Biotech KK, Tokyo, Japan".- Project Leader

(B) National:

I. Promotion and popularisation of Artificial Diet chawki rearing through Chawki Rearing Centre (April 2005 – March 2008) Funded by Department of Science and Technology (DST), Govt. of India, New Delhi. Project cost 6.0 lakh.

II. Large scale production, refinement and popularisation of semi-synthetic diet "Nutrid" for young instar silkworms (April 2005 – March 2007). Institute Industry partnership project. Project cost 50.5 lakh.

III. Institute – Village Linkage Programme (IVLP) – Project Investigator.

IV. Bivoltine promotion through Cluster promotion programme (CPP) - Project Investigator.

V. CSB funded projects/programmes >200

PART-II

CONTRIBUTIONS

of

DR. S. NIRMAL KUMAR

(Director, CSRTI, Berhampore)

to the

INDIAN SERICULTURE INDUSTRY

CONTRIBUTIONS OF DR. S.NIRMAL KUMAR TO THE INDIAN SERICULTURE INDUSTRY

Joined the services of Central Silk Board in the year 1978 as Senior Research Assistant at CTRTI, Ranchi. Since then, for the last 37 years working for the benefit of sericulture industry in various capacities at different institutes on different activities of the industry. The major areas of activities during the above service period cover the following aspects.

1. Silkworm breed development, maintenance and multiplication.
2. Silkworm rearing technologies especially
   i. Young age silkworm rearing
   ii. Rearing houses
   iii. Mountages, mounting and cocoon quality aspects.
3. Silkworm seed production, quality testing and distribution.
4. Extension system development and transfer of technology
5. HRD activities
6. Promotion of women involvement in sericulture
7. Mechanization in sericulture
8. Policy framing, institution building and planning activities.

The details of achievements and contributions made are detailed below:

Contributions made to sericulture stake holders:

I. Raw silk production:

As a silkworm breeder involved in the development of CSR2 bivoltine breed which is contributing maximum for the country's raw silk production by way of being one of the parents in single/Double hybrids and as a male component in cross breed.

II. Farmers

a) Commercial hybrid rearing:

1. Bivoltine single hybrid - CSR2 x CSR4 – Popular in the entire country since 1996.
2. Bivoltine double hybrid- (CSR6xCSR26) x (CSR2xCSR27) Popular in south India from 2001.
3. CSR3xCSR6 & CSR12xCSR6–Productive Bivoltine hybrids to be exploited commercially.
4. "Samrudhi" Hormone for increased output of cocoon/silk yield.

5. “Sampoorna” Hormone for uniform maturation and spinning of larvae. Can also be used as a crop saver in emergency like leaf shortage or outbreak of disease.

b) <u>Seed crop rearing</u>:

1. Bivoltine foundation crosses-CSR6xCSR26 & CSR2xCSR27 - For crop stability.
2. CSR2 as a male component for Pure Mysore race (PM x CSR2)
3. CSR2(SL) a male component for Multivoltine x Bivoltine Hybrid – For better returns.
4. “Sampoorna” For synchronized emergence of moths.

III. Grainages

1. Bivoltine foundation crosses (CSR6 x CSR26 & CSR2 x CSR27) cocoons-For high egg yield.
2. CSR2 (SL) as a male component in Multivoltine x Bivoltine Hybrid - For easy sex separation, no skill is required and saves labour and reduces cost of production.

IV. Reelers

1. Bivoltine Single Hybrid - CSR2 x CSR4 –High grade silk production
2. Bivoltine Double Hybrid-(CSR6 x CSR26) x (CSR2 x CSR27)– High grade silk production

V. Chawki rearing centres

1. “Serinutrid” Universal artificial diet for Multi x Bi hybrids – Reduces production cost.
2. Exclusive Multivoltine x Bivoltine diet hybrid - BL67A x CSR101A
3. Exclusive Biivoltine x Bivoltine diet hybrid – CSR2A x CSR4A
4. Silkworm growth Index as ready reckoner – can predict the crop performance.

VI. Silkworm breeders

1. Multiple trait evaluation Index – A new method to select promising breeds/hybrids.
2. Bivoltine silkworm breed maintenance and multiplication technology from P4 to P2.
3. A Bibliography of research work in silkworm breeding (1960- 2011)

VII.Vanya sericulture

1. Development of semi synthetic diet for Eri silkworms
2. Development of semi synthetic diet for Tassar silkworms
3. Development of semi synthetic diet for Muga silkworms

VIII. Product diversification for potential industrial applications – Value addition

1. Development of protocol for preparation of nutritious silkworm pupae for human food.
2. Development of protocol for preparation of nutritious, odorless pupae powder.
3. Development of protocol for preparation of transparent, odorless refined pupae oil.
4. Development of protocol for extracting virgin sericin.
5. Development of protocol for extracting fibroin.
6. Development of protocol for preparation of silkworm powder for human health benefits.

SILKWORM HYBRIDS AUTHOURISED

I. Productive Bivoltine single hybrids

1. CSR2 x CSR4 (1997)

Shell ratio of 22-24%,
Renditta – 5.6 to 6.1, Raw silk – 19 to 20%,
2A - 4A grade silk. Yield/100Dfls – 60 to 70 kg.

2. CSR2 x CSR5 (1997)

Shell ratio of 23-25%,
Renditta – 5.6 to 6.1, Raw silk – 19 to 20%,
2A - 4A grade silk.Yield/100Dfls – 60 to 70 kg.

3. CSR3 x CSR6 (1999)

Shell ratio of 23-25%, Renditta – 5.6 to 6.1, Raw silk – 19 to 20%, 3A- 4A grade silk. Yield/100Dfls – 60 to 70 kg.
CSR3 – Sex limited (Larval marking), and CSR6 – Marked larvae

Shell ratio of 23-25%,
Renditta – 5.6 to 6.1, Raw silk – 19-20%,
3A-4A grade silk. Yield/100Dfls – 60-70kg.
CSR12 – Sex limited (Larval marking)

II. Productive Bivoltine Double Hybrid

1. (CSR6 x CSR26) x (CSR2 x CSR27) (2004)

Robust foundation crosses.
Yields 65 to 70g. eggs/kg cocoons.
Double hybrid- yield/100 Dfls–60 to70 kg.
Renditta – 5.4 to 6.0 kg. Less defective cocoons. 2A to 4A grade silk.

III. Bivoltine Hybrid for Artificial Diet rearing

CSR2A x CSR4A (2004)


Shell ratio of 21-23%, Renditta – 5.6 to 6.5, Raw silk – 19-20%, 2A-4A grade silk. Yield/100Dfls – 60 to 70 kg.

IV. Multi x Bivoltine hybrid for Artificial Diet rearing

67A x CSR101A (2004)

Productive hybrid with survival >90%, Shell ratio of 20%, Renditta 6.5, silk grade A~2A
Recommended for irrigated areas of South India


Breeds developed for Artificial diet rearing

a) **Bivoltine 16**

b) **Multivoltine 9**

Hybrids developed for Artificial diet rearing.

a) **Bivoltine hybrids 15**

b) **Multivoltine hybrids 5**

c) **Multi x Bivoltine hybrids 15**

Development of Index

a) **Multiple Trait Evaluation Index for selection of breeds/hybrids**

b) **Silkworm Growth Index as ready reckoner for CRC**

L14 x CSR2 – A new Multivoltine x Bivoltine hybrid for quality silk

Reeling reports on Automatic Reeling Machine (2013)

	Reeling Parameter		*Grade*
I	**Average size (d)**	21.26	
II	**Major Tests**		
1.	Standard size deviation (d)	1.33	3A
2.	Evenness variation-I (stripes)	16	4A
3.	Evenness variation-II (stripes)	1	4A
4.	Cleanness (%)	98	4A
5.	Neatness (%)	95	4A
6.	Low neatness (%)	90	4A
III.	**Auxiliary Tests**		
1.	Maximum Deviation (d)	2.1	1
2.	Evenness variation-III (stripes)	0	1
3.	Winding breaks/10 skeins/ hrs	1	1
4.	Tenacity (g/d)	3.7	1
5.	Elongation (%)	18	1
6.	Cohesion (Strokes)	107	1
	Overall Grade		**3A**

V Instar L.D. < 1 day
Cocoon Shell > 19-20%
Renditta > 6.5 - 7 kg
Silk Quality: 2A - 3A Grade
Cocoon Rate: 15-20% higher

Fabric properties

#	*Parameter*		*Value*
1	Breaking strength	Warp	353.90
		Weft	266.90
2	Elongation	Warp	17.80
		Weft	12.50
3	Crease recovery angle	Warp	60.00
		Weft	68.00
4	Binding strength	Warp	3.50
		Weft	3.40
5	Flexural rigidity	Warp	207.50
		Weft	190.20
6	Drape Co-efficient		82.50

Technologies Commercialized

Sampoorna

A Technology for hastened maturation and synchronized spinning.

A plant–based steroid with moulting hormone activity. Used for early and uniform maturation. Saves labour in picking the matured worms. Reduces mounting period by 18–40 hours. The cocoon characters are not affected. Farmer can save Rs. 500 /100 Dfls. It also can save the crop when disease out breaks and from shortage of leaf in final instar.

Samrudhi

A Technology for enhanced cocoon/silk production

An analogue of insect juvenile hormone. On administration, an improvement of 12 to 15% realized in the cocoon wt. and shell wt with no notable variation in shell percentage. 6 to 12 kg increase in the cocoon yield. The net return ranges from Rs. 700 to 1200 per 100 dfls. Larval period extends by 12 to24 hrs. Consumes two extra feeds. Reeler gets additional one kg of silk for 100 dfls.

Serinutrid

A Technology for young instar rearing

Provides balanced nutrition to young silkworms leading to stable cocoon crops. Ensures good hygiene and reduces early infection. Only two feeding in each instar. No bed cleaning during chawki. Missing larvae are minimum. Saves labour during young instar rearing. No need to maintain separate chawki garden. Rs. 350 can be saved for every 100 Dfls.

Breakthrough Research

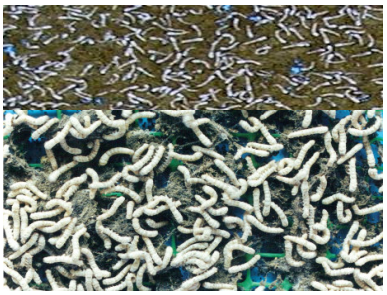
Natural Coloured Silk



Novel technique developed successfully for inducing the silkworms to produce coloured larvae, cocoons, silk fiber and fabric. A wide range of coloured cocoon/Silk can be achieved through this technique.

A Universal Semi synthetic diet for Young instar mulberry silkworms.

This technology completely removes the barrier that only specially evolved breeds are fit for diet consumption. This will help all the CRC's to rear hybrids of their choice of any source on semi-synthetic diet under the recommended diet technology practices. This is the first report in sericulture history that a universal diet is developed suiting the requirement of popularly exploited silkworm hybrids.



Dominant Trimoulters

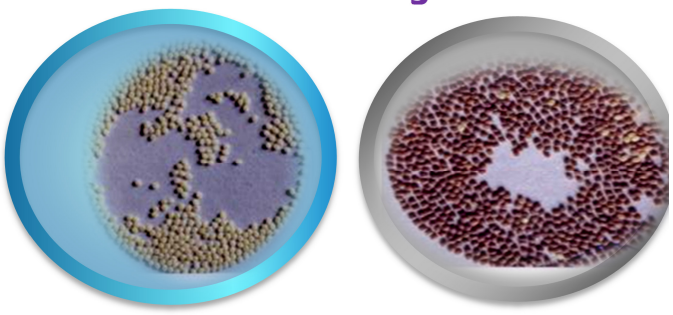
True dominant trimoulters TRI 1 and TRI 2 developed through directional selection. The derived trimoulters are breeding true to its characters for more than 8 generations. TRI 1 is plain where as TRI 2 is a marked larva. TRI 1 and TRI 2 have larval duration of 22 and 19.6 days, Filament length of 571& 419 mts. with denier of 1.26 & 1.33 respectively.

TRI 1

TRI 2

Promising Technology Developed

Introduction of *id* gene



non pigmented
non diapause

pigmented
non diapause

For the first time in silkworm *id* gene has been introduced. The advantage of which is, even when it is crossed with bivoltine female parent the resulting progeny lays only non diapause eggs. By utilizing this breed the hither too unutilized females of bivoltine and males of multivoltine which amounts to 50% loss can be totally avoided.

Semi-synthetic diet for Vanya Silkworms

ERI SILKWORMS

MUGA SILKWORMS

TASAR SILKWORMS

The semi synthetic diet for vanya silkworms are standardized along with the rearing package for young instars rearing. It is expected to bring down the initial loss of larvae to a great extent. This in turn will help to increase the cocoon production.