के.रे.ज.सं.के.

CSGRC

An Exclusive Centre for Seri-Biodiversity Conservation in India

केन्द्रीय रेशम जननद्रव्य संसाधन केन्द्र

केन्द्रीय रेशम बोर्ड, वस्त्र मंत्रालय, भारत सरकार

पी. बी. नं - 44, थली रोड, होसूर - 635 109, कृष्णगिरि जिला, तमिल नाडु, भारत।

आईएसओ 9001:2008 द्वारा मान्यता प्राप्त केन्द्र

CENTRAL SERICUL TURAL GERMPLASM RESOURCES CENTRE

Central Silk Board, (Ministry of Textiles – Govt. of India)

P.B. No.44, Thally Road, Hosur – 635 109, Tamil Nadu

e-mail : *csgrchos.csb@nic.in web : www.csgrc.res.in*

ISO 9001:2008 certified centre

CSGRC, Hosur conserves valuable genetic diversity of mulberry (*Morus spp.*) and silkworm (*Bombyx mori.*) which is a national treasure and foundation for prosperity of sericulture. The Convention on Biological Biodiversity (CBD) has bestowed the nations rights on the existing genetic resources. With the recent development concerning the breeders and farmers rights towards variety protection linked with Intellectual Property Rights (IPR) made effectively by signing of General Agreement on Trade and Tariff (GATT). In this context, the protection of the genetic material has become more important. It was during February 1991, CSB established Silkworm and Mulberry Germplasm Station (SMGS) at Hosur, Tamil Nadu and during April, 2000 renamed as Central Sericultural Germplasm Resources Centre (CSGRC) to function as a nodal centre at National level for both mulberry and non mulberry sericultural germplasm related activities. This centre is recognized as an advanced research centre by Mysore University and Karnataka University, Dharwad.

CSGRC, Hosur is recognized as National Active Germplasm Site (NAGS) for mulberry by National Bureau of Plant Genetic Resources (NBPGR), New Delhi and for silkworm by National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru

Fruit variability in *Morus* spp.

Cocoon and larval variability

Mandate

- *Exploration, collection, introduction and conservation of all sericultural germplasm.*
- *National accessioning and registration of sericultural germplasm resources.*
- *Quarantine and phytosanitary certification of all incoming and outgoing germplasm resources.*
- *Characterisation, evaluation and cataloguing of all the sericultural germplasm resources.*
- *Collaborate inter and intra organizational research activities pertaining to germplasm.*
- *Imparting training on germplasm resource management.*
- *Promotion of germplasm utilization within the country.*
- *Co-ordination of inter and intra state supply and exchange of all sericultural germplasm resources.*
- *To protect sericultural germplasm resources from extinction and preserve such national heritage for posterity.*

Activities

- *To explore, collect and introduce mulberry and silkworm germplasm.*
- *To undertake characterisation, classification, preliminary evaluation & cataloguing of germplasm collection for promoting utilization of genetic resources.*
- *To serve as the long-term national repository of sericultural genetic resources and national accessioning.*
- *To act as a nodal agency for registration and reference centre for important germplasm resources.*
- *To play a lead role in the inter institutional collaboration for screening /testing / evaluation of sericultural germplasm.*
- *To co-ordinate import and export of genetic resources along with quarantine check pertaining to incoming germplasm and issuing phytosanitary certificate for export of germplasm.*
- *To serve as the national database and herbarium/ display of sericultural genetic resources.*
- *To supply the germplasm to all needy organizations.*
- *To impart training in sericultural germplasm resource management.*

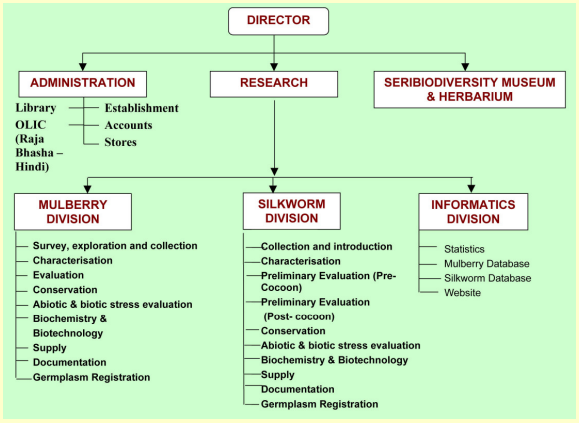
The organization and infrastructure

The organizational set up of the institute includes two major scientific divisions' *viz.,* mulberry germplasm division and silkworm germplasm division. The institute has strength of 10 scientists, 7 technical and 14 administrative personnel and 37 Skilled Farm Workers. It is located on 59.28 acres of land. The main building, houses the administrative office along with computer facilities, library and laboratories of mulberry, silkworm characterization and evaluation, tissue culture, biochemistry and biotechnology. The centre is equipped with advanced microscopes, laminar flow chambers, leaf area meter, tissue culture unit, PCR engines, Tissue culture and cryo-preservation units, spectrophotometer, nitrogen analyzer, portable photosynthesis system, CO_2 incubator and other essential equipments required for different research projects. Altogether 20 acres of land is under mulberry cultivation including mulberry *ex-situ* field gene bank (9 acres). Four rearing houses with 400-500 dfls rearing capacity in each house are available. A grainage with mother moth testing facilities is also developed for seed preparation, moth examination. A silk reeling laboratory supported with boiler and silk testing machine from Japan is also installed.

CSGRC Physio geographical information

Latitude	: 12° 43 12" N
Longitude	: 77°49' 12" E
Altitude	: 942 m MSL
Region	: Deccan plateau
Climate	: Tropical - Dry
Temperature	: Min. 8-19°C Max. : 27-36°C
Relative Humidity	: Min. 37- 59% , Max. 56-90%.
Monsoon	: North East (August - November)
No. of rainy days/year	: 38 - 44
Wind speed	: 0.85 - 21.80 km/hr.
Annual rainfall	: 800 - 1000 mm
Soil type/ texture	: Red laterite, Sandy loam
Soil pH	: 6.8 - 7.5
Soil Fertility	: Medium

To meet the objectives of a display centre for mulberry and silkworm germplasm resources, a museum has been organized. A biodiversity museum of mulberry and silkworm genetic resources has been developed with local and improved varieties. A herbarium with specific details on the mulberry germplasm has also been developed. One guesthouse with 4 double bed room facility is also available. The Local Area Network and broad band Internet facility is installed in all the laboratories and Administrative office of the centre.



Interaction with Students and Farmers in the Field Gene Bank and Seri-Biodiversity Museum

Mulberry germplasm conservation

Sl.No.	Country	Acc.	State	Acc.
1	Afghanistan	2	A & N Islands	15
2	Australia	2	Andhra Pradesh	4
3	Bangladesh	5	Arunachal Pradesh	9
4	China	53	Assam	11
5	Cyprus	1	Bihar	9
6	Egypt	3	Chhattisgarh	4
7	France	32	GOA	11
8	Hungary	1	Gujarat	16
9	India	999	Haryana	13
10	Indonesia	6	Himachal Pradesh	36
11	Italy	7	Jammu & Kashmir	41
12	Japan	70	Jharkhand	17
13	Myanmar	7	Karnataka	152
14	Pakistan	8	Kerala	71
15	Papua New Guinea	1	Madhya Pradesh	12
16	Paraguay	4	Maharastra	32
17	Philippines	1	Manipur	12
18	Portugal	1	Meghalaya	23
19	Russia	1	Mizoram	8
20	S. Korea	6	Nagaland	9
21	Spain	2	New Delhi	3
22	Thailand	11	Orissa	1
23	Turkey	1	Pondicherry	4
24	Zimbabwe	11	Punjab	18
25	USA	2	Rajasthan	60
26	Venezuela	1	Sikkim	15
27	Vietnam	3	Tamil Nadu	86
28	Others	28	Tripura	2
29			Uttar Pradesh	146
30			Uttaranchal	8
31			West Bengal	151
	Total	**1269**		**999**

Mulberry National Cryo Gene Banking

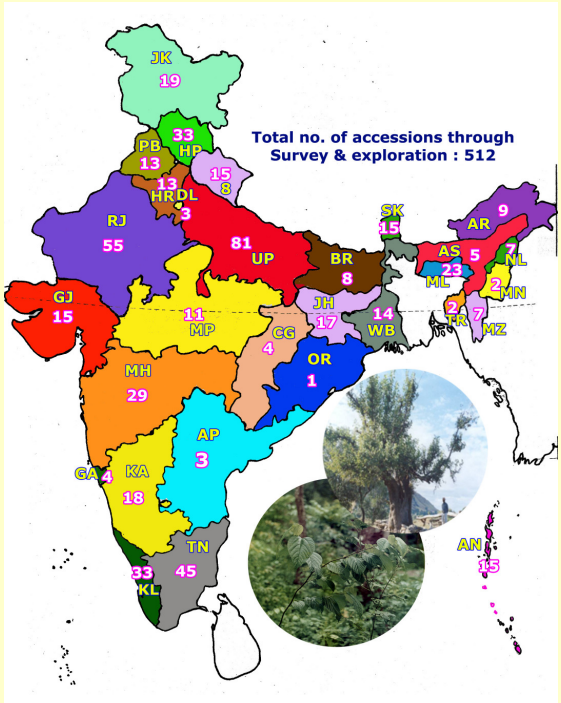
- 338 mulberry accessions (Endangered & wild genetic resources, poor rooters, exotics, core collections, local land races, promising accessions) were cryo-preserved at National cryo gene bank (–196°C), NBPGR, New Delhi using dehydration and slow freezing technique.
- Regeneration of cryopreserved mulberry germplasm accessions after 1~6 years of storage indicated no survival loss over different years of storage.
- Molecular markers indicated genetic stability of cryopreserved mulberry germplasm

Morus species	No. of Acc.
M.indica	151
M.alba	52
M.laevigata	27
M.latifolia	18
M.bombycis	7
M.serrata	3
M.multicaulis	3
M.sinensis	2
M.macroura	2
M.australis	2
M.rubra	1
M.nigra	1
M.cathayana	1
M.tiliaefolia	1
M.rotundiloba	1
Morus.spp.	66
Total	338

Silkworm germplasm conservation

Sl.No.	Country	MV	BV	Total
1	Bangladesh	3	0	3
2	Brazil	0	3	3
3	China	4	40	44
4	France	0	11	11
5	India	71	233	304
6	Indonesia	0	1	1
7	Iraq	0	1	1
8	Japan	3	64	67
9	Poland	0	3	3
10	Russia	0	19	19
11	South Korea	0	1	1
12	Thailand	0	4	4
13	Ukraine	0	2	2
14	Vietnam	0	3	3
Total		81	385	466

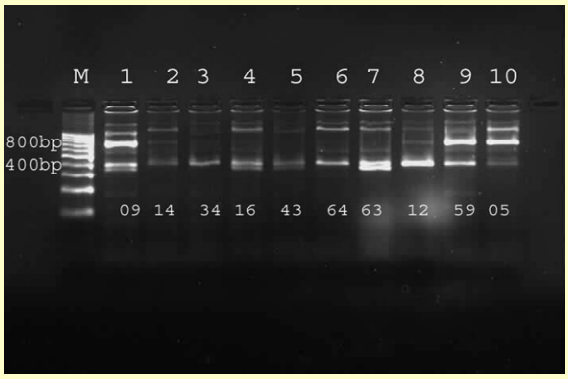
Sl.No.	State	MV	BV	Total
1	Andhra Pradesh	9	4	13
2	Assam	4	2	6
3	Jammu & Kashmir	83	0	85
4	Karnataka	79	33	112
5	Maharashtra	0	2	2
6	Tamil Nadu	17	3	20
7	Uttar Pradesh	10	0	10
8	Uttranchal	6	0	6
9	West Bengal	19	27	48
	Total	233	71	304



Mulberry accessions in the Field Gene Bank of CSGRC, Hosur collected through Survey and Exploration

Current research programme on mulberry and silkworm germplasm management

- Survey, exploration and collection in different geographical regions of the country.
- Characterisation and evaluation of the germplasm for morphological, reproductive, anatomical, biochemical, growth and yield and molecular parameters
- Evaluation of germplasm for identification of elite germplasm and screening against biotic and abiotic stresses (water and nitrogen efficiency, drought, saline and alkaline tolerance)
- *Ex situ* conservation as living stands and Cryo preservation of mulberry, silkworm and promoting *in situ* conservation.
- Utilization of germplasm adopting different schedule and supply to different universities and research institutes of the country.
- Identification of region and season specific germplasm through multi location trials in different agro-ecological regions.
- Registration and national accessioning of sericultural germplasm.



DNA profile of Multivoltine silkworm races

Vision for next 20 years

- ✓ Collection of exotic mulberry and silkworm germplasm from sericulturally advanced countries.
- ✓ Establishment of safety backup of serigenetic resources to cope up with environmental challenges.
- ✓ Development and utilization of cryo-preservation techniques for long term conservation.
- ✓ Collection of germplasm from climate stressed regions and evaluating in hot spots to identify traits and genetic resources which can be used in development of climate resilient varieties/ breeds.
- ✓ Development of molecular IDs for seri-genetic resources to reduce duplicates.
- ✓ Use of molecular tools for large scale screening of genetic resources for abiotic and biotic stresses.
- ✓ Identification of novel genes in wild genetic resources and promoting their utilization through prebreeding.
- ✓ Promoting their utilization of genetic resources for non-sericultural purposes.
- ✓ Improvement of rainwater harvesting in CSGRC campus and switching over to water saving irrigation systems.
- ✓ Human Resources Development on seribiodiversity management.
- ✓ Extending biodiversity conservation programme in non mulberry sector.

Achievements

Mulberry Germplasm

- CSGRC, Hosur has large collection of mulberry germplasm assembled through survey exploration and introduction. The collections include diverse resources such as wild, landraces, local cultivars, polyploids and advanced cultivars with diversity.
- More than 80 survey and explorations were conducted in different geographical regions of India, *viz.*, arid and semi arid regions of Rajasthan, cold deserts of Ladakh Himalayan region including centre of diversity for different *Morus* species particularly in Uttaranchal and Uttar Pradesh, saline regions of Andaman Islands, Central and South India. Out of this 512 mulberry accessions are identified as diverse and added in the *ex situ* field gene bank.
- 1125 mulberry accessions have been systematically characterized and evaluated for 100 descriptors on morphology, reproduction, anatomy, growth, yield and biochemical parameters and developed Mulberry Germplasm Information System (MGIS).
- Thirteen *Morus* species and 80 mulberry land races from different geographical regions were studied using 10 enzymes which revealed 12 isozyme loci and 38 alleles. Higher gene flow and genetic diversity estimated for Indian species for developing conservation strategies.
- The mulberry *ex situ* field gene bank conserves 1269 mulberry accessions (999 indigenous and 270 exotic) from diverse genetic and geographical regions belonging to 13 *Morus* species collected from 26 countries.
- Core collection set of 150 mulberry accessions were identified utilizing DNA marker aided analysis for undertaking MAS breeding activities for crop improvement and conservation programmes.
- 338 mulberry accessions have been cryopreserved in the national cryo gene bank (-196° C) of National Bureau of Plant Genetic Resources (NBPGR) at New Delhi.
- National accession numbers have been assigned for 1151 mulberry genetic resources by NBPGR, New Delhi for the genetic identity.
- Five catalogues were published on mulberry genetic resources with database of 1078 mulberry accessions for 100 descriptors with identification trait specific promising accessions.
- 38 mulberry accessions (CSRTI, Mysore - 23, CSRTI, Berhampore – 6, KSSRDI, Bengaluru - 3 and CSGRC - 6) and 8 muga accessions (Ladoigarh) have been registered by the breeders in order to protect the IPR rights.
- Mulberry Germplasm Information System (MGIS) and National Database on mulberry germplasm was developed and five catalogues were published on mulberry genetic resources with database of 1078 mulberry accessions for more than 100 descriptors with trait specific promising accessions.
- Since inception 786 mulberry indigenous genetic resources (2840 times repeated supply) and 210 exotic genetic resources (1128 times) were supplied to different indenters.

Trait Specific Mulberry Genetic Resources identified for utilisation	
High leaf yield and biomass (kg)	MI-0853, MI-0854, MI-0867, MI-0849, MI-0827, MI-0848, MI-0867, MI-0665, MI-0669, MI-0828, ME-0223, ME-0169, ME-0179, ME-0191, ME-0142, ME-0151, ME-0182, ME-0210, ME-0189, ME-0207
High harvest index	MI-0819, MI-0157, MI-0817, MI-0153, MI-0818, MI-0747, MI-0028, MI-0148, ME-0091, ME-0076, ME0079, ME-0105, ME-0078, ME-0032, ME-0108, ME-0089, ME-0063
High water retention capacity (%)	MI-0812, MI-0811, MI-0241, MI-0330, MI-0854, MI-0009, MI-0018, MI-0011, MI-0350, MI-0143, ME-0108, ME-0073, ME-0149, ME-0101 , ME-0168, ME-0174, ME-0116, ME-0192, ME-0124, ME-0198
High rooting (%)	MI-0527, MI-0759, MI-0501, MI-0792, MI-0797, MI-0509, MI-0516, MI-0272, MI-0789, MI-0820, MI-0376, MI-0710, MI-0829, MI-0316, MI-0832, MI-0828, MI-0281, ME-0122, ME-0100, ME-0159, ME-0006, ME-0220, ME-0254, ME-0162, ME-0151, ME-0251, ME-0149, ME-0140, MI-0256,MI-0332
High ranking for Multiple traits on growth traits	MI-0827, MI-0665, MI-0669, MI-0790, MI-0853, MI-0786, MI-0789, MI-0810, MI-0346, MI-0573, MI-0477, ME-0169, ME-0179, ME-0207, MI-0308
Water Use efficiency (WUE)	
High performing under water stress for multiple traits	MI-0768, MI-0762, MI-0477, MI-0622, MI-0226, MI-0657, MI-0763, MI-0346, MI-0025, MI-0699, MI-0314, MI-0214, MI-0670, MI-0827, MI-0161, MI-0256, MI-0332, MI-0768
Low leaf senescence under water stress	MI-0416, MI-0447, MI-0025, MI-0314, MI-0323, MI-0332, MI-0544, MI-0438, MI-0226, MI-0214, MI-0765, MI-0491, ME-0107, MI-0535, ME-0095, ME-0167,ME-0173, ME-0016, ME-0244, ME-0071, ME-0250, MI-0657, MI-0256, MI-0836, MI-0683, MI-0763, ME-0125, MI-0437, MI-0262, MI-0513, MI-0298, MI-0768, MI-0682, MI-0827, MI-0346, MI-0400

Trait Specific Mulberry Genetic Resources identified for utilization (contd…)	
Nitrogen use efficiency	
Only under low nitrogen (30 kg N/Ha/Y)	MI-0685, MI-0683
Only under high nitrogen (300 kg N/Ha/Y)	MI-0139, MI-0178, MI-0573, MI-0416, MI-0193, MI-0533
Both high and low N	MI-0762, MI-0477, MI-0622, MI-0226, MI-0657, MI-0763, MI-0346, MI-0025, MI-0699, MI-0314, MI-0214, MI-0670, MI-0827, MI-0161
Alkaline tolerance (pH-9)	MI-0437,MI-0376, MI-0327, MI-0670, MI-0657, MI-0012, MI-0476, MI-0242, MI-0129, MI-0245, MI-0161, MI-0763, MI-0716, MI-0310, MI-0145, MI-0497, MI-0499, MI-0027, MI-0139, MI-0764
Saline tolerance (EC 6dS/m)	MI-0226, MI-0670, MI-0836, MI-0652, MI-0762, MI-0449, MI-0764, MI-0437, MI-0716, MI-0822, MI-0310, MI-0248, MI-0702, MI-0190, MI-0643, MI-0499, MI-0788, MI-0466
All India Mulberry Germplasm Evaluation Programme (AIMGEP)	
Hosur, Tamil Nadu	MI-0437, MI-0376
Berhampore, West Bengal	MI-0310, MI-0324, MI-0376
Pampore, Jammu and Kashmir	ME-0167, ME-0130, ME-0173, ME-0168
Mysore, Karnataka	MI-0310, MI-0326
Coonoor, Tamil Nadu	ME-007, ME-0033, ME-0130, ME-0169
Miransahib, Jammu and Kashmir	MI-0324, MI-0252
Sahaspur, Uttranchal	MI-0439, MI-0416, MI-0431
Jorhat, Assam	MI-0154, MI-0369, MI-0416, MI-0349, MI-0388
Hot Spot Screening for abiotic stress tolerance	
Tropical semi arid (Ananthapur, Andhra Pradesh)	MI-0463, MI-0458, MI-0461, MI-0244, MI-0573, MI-0469, MI-0173
Alkaline and rainfed, (Chamarajanagar, Karnataka)	MI-0204, MI-0173, MI-0024, ME-0006, ME-0052
Tropical hot and high humid (Jorhat)	MI-0549, MI-0576, MI-0469, MI-0587
Tropical alkaline and irrigated (Salem, Tamil Nadu)	ME-0052, MI-0204, ME-0006, MI-0369, MI-0437, MI-0439, ME-0065, MI-0211, MI-0172
Temperate (Pampore)	ME-0006, ME-0191, ME-0201, ME-0210
Tolerant to cryo-preservation (-196°C)	MI-0678, MI-0702, MI-0029, MI-0111, MI-0237, MI-0670, MI-0225, MI-0237, MI-0472, MI-0015, MI-0025, MI-0058, MI-0185, MI-0187, ME-0022, ME-0002, ME-0025, ME-0058, ME-0028, ME-0073, ME-0065, ME-0062, ME-0064, ME-0174

Trait Specific Mulberry Genetic Resources identified for utilization (contd…)	
High fruit yielding	ME-0010, ME-0018, ME-0050, ME-0053, ME-0095, MI-0020, MI-0056, MI-0062, MI-0118, MI-0137, MI-0155, MI-0171, ME-0172, MI-0188, MI-0189, MI-0209, MI-0249, MI-0209, MI-0249, MI-0264, MI-0265, MI-0266, MI-0290, MI-0300, MI-0323, MI-0338, MI-0346, MI-0362, MI-0363, MI-0369, MI-0401, MI-0467, MI-0468, MI-0495, MI-0412, MI-0496, MI-0497, MI-0502, MI-0503, MI-0505, MI-0507, MI-0508, MI-0509, MI-0512, MI-0518, MI-0535, MI-0632, MI-0704, MI-0705, MI-0706, MI-0777, MI-0789, MI-0827, MI-0665, MI-0669, MI-0790, MI-0853, MI-0786, MI-0789, MI-0380, MI-0420, MI-0427, MI-0519
Tolerant to Tukra infestation	MI-0055, MI-0555, MI-0206, MI-0096, ME-0165, MI-0208, ME-0239, MI-0909, MI-0355
Tolerant to Powdery mildew	ME-0104, MI-0095, ME-0182, ME-0189, ME-0260, ME-0045, ME-0039, MI-0006, ME-0095, ME-0178 MI-0054, MI-0167, MI-0061, ME-0030, MI-0048, ME-0062, MI-0013, ME-0019, MI-0098, ME-0173, ME-0129, MI-0138

Silkworm Germplasm

- The silkworm collections include 466 silkworm genetic resources (81 MV and 365 BV and 20 mutants) from 9 states of the country and 14 countries across the world and conserved following standard protocols.
- NBAIR, Bengaluru has assigned unique national accession numbers for all the 466 silkworm genetic resources.
- All the 466 silkworm genetic resources have been characterized and evaluated following standard descriptors and the data has been documented in the SGIS database along with the passport information.
- Silkworm Germplasm Information System (SGIS) was developed and three volumes of catalogues on silkworm germplasm were published and circulated to all the breeding institutes and State sericultural research institutes and people involved in sericultural research and conservation besides the catalogues are made in CD form and available for needy institutes.
- In order to protect the IPR rights of breeders the centre has so far registered 43 silkworm races developed by different breeding Institutes which includes CSRTI, Berhampore (5) in 2002, APSSRDI, Hindupur (5), KSSRDI, Bengaluru (14), CSRTI, Mysore (16) in 2004 and KSSRDI, Bengaluru (2) in 2009 and SSTL, Kodathi (1) in 2012.

- Since inception 217 BV accessions and 72 MV accessions were supplied to 42 Institutions in 326 spells for PG research, evaluation, breeding resources, project works and breed maintenance purposes. The most indented accessions in BV are NB4D2 (91), CSR-2 (75), RS-5 (44), J2P (44) and CA-2 (44) similarly in MV it is PM (100), Nistari (70), G (41), OS-616 (39) and C.Nichi (39) and Karnataka University, Dharwad, TNAU, Coimbatore, RSRS, Sahaspur, RSRS, Jammu, CSRTI,Mysore are the major Institutes to which the silkworm genetic resources were supplied.
- Under the hot spot evaluation project of bivoltine germplasm for abiotic stress conditions at different agro climatic areas (2003-2007) accessions BBE-0266 and BBE-0178 have performed better than both the local ruling breeds and national control CSR-2 for rearing and reeling parameters at high temperature and high humidity prevailing during the autumn season. Accession BBE-0198 and BBE-0266 were identified for less disease incidence hence these silkworm germplasm accessions can be exploited by breeders to evolve hardy races for autumn rearing.
- The promising multivoltine accessions identified under high temperature / high humidity and high temperature / low humidity conditions are accessions BMI-0045, BMI-0025, BMI-0027, BMI-0060 for Ananthapur, Chamarajanagar and Salem zones. BMI-0040, BMI-0025, BMI-0027 and BMI-0016 for abiotic and BMI-0027 for biotic stress for Jorhat zone.
- Two phases of AISGEP were completed. BBE-0222, BBE-0183, BBE-0197, BBE-0187 were identified as promising accessions in different agro climatic zones in AIMSGEP-I and accessions BBI-0348, BBE-0216, BBE-0329, BBI-0338 and BBE-0266 were identified as better performers in AISGEP phase II.

केन्द्रीय रेशम बोर्ड / CENTRAL SILK BOARD
वस्त्र मंत्रालय, भारत सरकार / MINISTRY OF TEXTILES, GOVT. OF INDIA
केरेबो कॉम्प्लेक्स, बी.टी.एम लेआउट, मडिवाला, बैंगलूर- 560 068, कर्नाटक राज्य, भारत।
CSB COMPLEX, B.T.M. LAYOUT, MADIVALA, BENGALURU - 560 068, KARNATAKA STATE. INDIA.

मान्यता प्रमाण - पत्र / RECOGNITION CERTIFICATE

यह प्रमाणित किया जाता है कि शहतूत (मोरस प्रजाति) एवं शहतूत रेशमकीट (बॉम्बीक्स मोरी एल.) को जननद्रव्य हेतु केन्द्रीय रेशम जननद्रव्य संसाधन केन्द्र (केरेजर्सके), केन्द्रीय रेशम बोर्ड, वस्त्र मंत्रालय, भारत सरकार, होसूर – 635 109, तमिलनाडु केवल एकमात्र केन्द्र है जिसे 1992 से राष्ट्रीय भंडार के तौर पर मान्यता प्रदान किया गया है तथा आईसीएआर - राष्ट्रीय पादप आनुवंशिक संसाधन ब्यूरो, नई दिल्ली द्वारा एवं आईसीएआर - राष्ट्रीय कृषि कीट संसाधन ब्यूरो, बैंगलूरु द्वारा क्रमशः शहतूत एवं रेशमकीट जननद्रव्य संसाधनों के लिए राष्ट्रीय सक्रिय जननद्रव्य साइट्स (एनएजीएस) के रूप में भी मान्यता प्रदान किया गया है।

Certified that the Central Sericultural Germplasm Resources Centre (CSGRC), Central Silk Board, Ministry of Textiles, Govt. of India, Hosur- 635 109, Tamil Nadu is the only centre recognized as a National Repository for Mulberry (Morus spp.) and mulberry silkworm (Bombyx mori L.) germplasm resources since 1992 and also recognized as National Active Germplasm Sites (NAGS) for mulberry and silkworm germplasm resources by ICAR-National Bureau of Plant Genetic Resources (NBPGR), New Delhi and ICAR-National Bureau of Agricultural Insect Resources (NBAIR), Bangalore, respectively.

स्थान / Place : बैंगलूरु / Bengaluru
दिनांक / Date : 20/08/2015

सदस्य सचिव
Member Secretary
(Dr. H. NAGESH PRABHU, IFS)

Trait Specific Silkworm Genetic Resources identified for utilization

Bivoltine Germplasm	
Fecundity (No.)	BBI-0277, BBI-0066, BBE-0010, BBI-0357, BBE-0043, BBE-0156, BBI-0343, BBI-0344, BBE-0035, BBI-0046
Hatching (%)	BBE-0182, BBE-0199, BBE-0162, BBE-0268, BBI-0080, BBE-0164, BBI-0255, BBE-0013, BBI-0122, BBI-0059
Wt. of 10 Larvae (g).	BBE-0035, BBE-0206, BBI-0129, BBI-0349, BBE-0270, BBE-0267, BBE-0262, BBE-0266, BBI-0367, BBI-0090
Total larval duration (h)	BBE-0025, BBE-0026, BBI-0073, BBE-0013, BBE-0015, BBE-0012, BBE-0021, BBI-0072, BBE-0032, BBE-0011
Fifth Larval duration (h)	BBE-0025, BBE-0026, BBI-0073, BBE-0015, BBE-0013, BBE-0021, BBI-0072, BBE-0012, BBE-0011, BBI-0059
ERR (By No.)	BBE-0228, BBI-0207, BBE-0171, BBI-0304, BBI-0243, BBE-0229, BBE-0209, BBI-0140, BBE-0178, BBE-0260
ERR (By Wt.) (Kg).	BBI-0349, BBI-0344, BBI-0336, BBI-0357, BBI-0293, BBI-0338, BBI-0122, BBI-0086, BBI-0303, BBE-0035
Pupation rate (%)	BBE-0228, BBI-0207, BBE-0260, BBI-0304, BBI-0237, BBE-0209, BBI-0289, BBE-0229, BBE-0268, BBI-0243
Single Cocoon Weight (g).	BBI-0349, BBI-0344, BBE-0035, BBI-0350, BBI-0303, BBI-0345, BBI-0348, BBI-0357, BBE-0164, BBI-0086
Single Shell Weight (g.)	BBI-0344, BBI-0364, BBI-0349, BBE-0197, BBE-0262, BBE-0270, BBE-0332, BBI-0370, BBI-0339, BBI-0328
Cocoon Shell Percentage (%)	BBE-0197, BBI-0370, BBE-0262, BBI-0328, BBI-0364, BBE-0264, BBE-0252, BBI-0359, BBE-0179, BBI-0368
Cocoon yield /100dfls (Kg.)	BBI-0349, BBI-0344, BBI-0336, BBI-0357, BBI-0293, BBI-0122, BBI-0086, BBI-0338, BBE-0035, BBI-0303
Filament Length (m)	BBI-0275, BBE-0267, BBE-0266, BBE-0265, BBI-0326, BBE-0225, BBE-0262, BBE-0263, BBE-0270, BBE-0268
Non broken filament Length (m)	BBE-0171, BBE-0201, BBE-0216, BBE-0225, BBE-0214, BBE-0177, BBI-0172, BBE-0263, BBI-0326, BBE-0270
Denier	BBE-0026, BBI-0248, BBI-0362, BBE-0280, BBE-0218, BBE-0195, BBI-0062, BBI-0126, BBI-0115, BBI-0093
Reelability %	BBE-0210, BBE-0201, BBE-0200, BBE-0227, BBI-0237, BBI-0304, BBI-0289, BBI-0368, BBE-0211, BBE-0212

Trait Specific Silkworm Genetic Resources identified for utilization (contd…)	
Bivoltine Germplasm	
Renditta (kg)	BBE-0182, BBE-0262, BBI-0325, BBE-0263, BBI-0364, BBE-0246, BBE-0232, BBE-0187, BBE-0238, BBI-0326
Raw silk Recovery (%)	BBE-0143, BBE-0246, BBI-0114, BBE-0182, BBE-0262, BBE-0232, BBE-0216, BBI-0235, BBI-0364, BBE-0167
Reeling waste (%)	BBE-0182, BBE-0187, BBE-0178, BBI-0140, BBE-0013, BBE-0263, BBE-0262, BBI-0286, BBI-0294, BBE-0008
Raw Silk (%)	BBE-0182, BBE-0262, BBI-0325, BBE-0263, BBI-0364, BBE-0246, BBE-0232, BBI-0203, BBE-0187, BBE-0238
Neatness (%)	BBI-0237, BBI-0124, BBE-0185, BBI-0361, BBI-0363, BBI-0125, BBI-0106, BBE-0264, BBI-0132, BBI-0358
Low neatness (%)	BBI-0237, BBE-0188, BBE-0177, BBI-0132, BBE-0265, BBE-0264, BBI-0112, BBI-0125, BBE-0185, BBI-0124
Boil off-loss (%)	BBE-0250, BBI-0369, BBI-0257, BBE-0224, BBI-0237, BBI-0253, BBE-0011, BBI-0366, BBI-0215, BBI-0277
Cleanness (%)	BBE-0185, BBI-0368, BBE-0033, BBI-0364, BBE-0244, BBI-0347, BBI-0334, BBI-0358, BBE-0018, BBE-0035
Evenness variation (no of stripes)	BBI-0117, BBI-0122, BBI-0273, BBI-0237, BBI-0276, BBI-0077, BBI-0111, BBI-0121, BBE-0187, BBI-0082
Tenacity (g/d)	BBE-0040, BBI-0287, BBE-0280, BBI-0367, BBI-0285, BBE-0169, BBI-0249, BBI-0368, BBI-0327, BBI-0062
Elongation (%)	BBE-0238, BBI-0303, BBI-0343, BBI-0129, BBI-0358, BBI-0357, BBI-0122, BBI-0338, BBE-0200, BBI-0300
Cohesion (no.of strokes)	BBI-0115, BBE-0188, BBI-0095, BBE-0197, BBI-0136, BBE-0049, BBE-0023, BBI-0285, BBI-0294, BBI-0327
Multivoltine Germplasm	
Trait	**Accession No.**
Fecundity (No.)	BMI-0080, BMI-0078, BMI-0077, BMI-0079, BMI-0076, BMI-0074, BMI-0082, BMI-0081, BMI-0014, BMI-0055
Hatching (%)	BMI-0062, BMI-0023, BMI-0067, BMI-0028, BMI-0002, BMI-0036, BMI-0064, BMI-0026, BMI-0024, BMI-0043
Wt. of 10 Larvae (g.)	BMI-0082, BMI-0081, BMI-0077, BMI-0078, BMI-0080, BMI-0074, BMI-0076, BMI-0079, BME-0048, BMI-0073
Total larval duration (h)	BMI-0033, BMI-0035, BMI-0058, BMI-0040, BMI-0038, BMI-0036, BMI-0039, BMI-0054, BMI-0060, BMI-0059

Trait Specific Silkworm Genetic Resources identified for utilization (contd…)	
Multivoltine Germplasm	
ERR (By No.)	BMI-0002, BMI-0022, BME-0013, BMI-0011, BMI-0019, BMI-0017, BMI-0021, BMI-0009, BMI-0003, BMI-0020
ERR (By Wt.) (Kg.)	BMI-0081, BMI-0080, BMI-0082, BMI-0074, BMI-0076, BMI-0025, BMI-0073, BMI-0078, BMI-0024, BMI-0009
Pupation rate (%)	BMI-0009, BMI-0022, BMI-0029, BME-0015, BMI-0020, BME-0013, BMI-0039, BMI-0011, BMI-0003, BMI-0019
Single Cocoon Weight (g.)	BMI-0081, BMI-0080, BMI-0077, BMI-0082, BMI-0076, BMI-0078, BMI-0074, BMI-0075, BMI-0024, BME-0048
Single Shell Weight (g.)	BMI-0081, BMI-0080, BMI-0082, BMI-0076, BMI-0077, BMI-0074, BMI-0078, BMI-0075, BMI-0079, BMI-0073
Cocoon Shell Percentage (%)	BMI-0082, BMI-0076, BMI-0081, BMI-0080, BME-0050, BMI-0074, BMI-0031, BMI-0079, BMI-0032, BMI-0073
Cocoon yield /100dfls (Kg.)	BMI-0081, BMI-0080, BMI-0082, BMI-0074, BMI-0076, BMI-0025, BMI-0073, BMI-0078, BMI-0024, BMI-0009
Filament Length (m)	BMI-0076, BMI-0009, BMI-0014, BMI-0034, BMI-0082, BMI-0079, BMI-0016, BMI-0081, BMI-0032, BMI-0055
Non broken filament Length (m)	BMI-0076, BMI-0079, BMI-0009, BMI-0021, BMI-0077, BMI-0081, BMI-0016, BMI-0082, BMI-0078, BMI-0008
Denier	BMI-0010, BME-0015, BMI-0016, BME-0013, BMI-0014, BMI-0009, BMI-0008, BME-0005, BMI-0029, BMI-0076
Reelability (%)	BMI-0079, BMI-0077, BMI-0067, BMI-0071, BMI-0063, BMI-0064, BMI-0021, BMI-0078, BMI-0076, BMI-0053
Renditta (kg)	BMI-0076, BMI-0079, BME-0030, BMI-0077, BMI-0027, BMI-0081, BMI-0033, BMI-0080, BMI-0043, BMI-0078
Raw silk Recovery %	BME-0030, BMI-0033, BMI-0055, BMI-0027, BMI-0076, BMI-0071, BMI-0034, BME-0050, BMI-0079, BMI-0043
Reeling waste (%)	BME-0030, BMI-0041, BMI-0053, BME-0050, BMI-0027, BMI-0021, BMI-0055, BMI-0079, BMI-0057, BMI-0054
Raw Silk (%)	BMI-0076, BMI-0079, BME-0030, BMI-0077, BMI-0027, BMI-0081, BMI-0080, BMI-0033, BMI-0043, BMI-0078
Neatness(%)	BMI-0004, BMI-0008, BME-0015, BMI-0011, BMI-0038, BMI-0016, BMI-0014, BMI-0003, BMI-0007, BMI-0042

Trait Specific Silkworm Genetic Resources identified for utilization (contd…)	
Multivoltine Germplasm	
Low neatness (%)	BMI-0008, BME-0015, BMI-0038, BMI-0014, BMI-0011, BMI-0016, BMI-0042, BMI-0004, BMI-0055, BMI-0025
Boil off-loss (%)	BMI-0041, BMI-0036, BME-0005, BMI-0008, BMI-0045, BMI-0046, BMI-0043, BMI-0074, BMI-0009, BME-0050
Cleanness (%)	BMI-0046, BMI-0040, BMI-0082, BMI-0031, BMI-0062, BMI-0058, BMI-0045, BMI-0079, BMI-0080, BMI-0081
Evenness variation (no of stripes)	BMI-0043, BMI-0032, BME-0052, BME-0048, BME-0047, BMI-0046, BMI-0065, BMI-0034, BMI-0055, BMI-0033
Tenacity (g/d)	BMI-0077, BMI-0062, BMI-0035, BMI-0065, BMI-0082, BMI-0058, BMI-0061, BMI-0063, BMI-0003, BMI-0076
Elongation (%)	BMI-0070, BMI-0078, BMI-0069, BMI-0076, BMI-0075, BMI-0074, BMI-0072, BMI-0068, BMI-0071, BMI-0020
Cohesion (no. of strokes)	BMI-0029, BMI-0027, BMI-0008, BMI-0038, BMI-0003, BMI-0016, BMI-0026, BME-0049, BMI-0046, BMI-0021

Bivoltine accessions selected through All India Silkworm Germplasm Evaluation Programme	
Phase-I	
Temperate Region	BBE-0222, BBE-0183
Sub tropical region	BBE-0197
Tropical region	BBE-0183, BBE-0187
Temperate and tropical region	BBE-0183
Phase-II	
Southern zone	BBI-0348, BBE-0216, BBE-0329
Sub tropical region	BBI-0348, BBE-0216, BBE-0329, BBE-0266
Eastern zone	BBI-0348, BBE-0216, BBE-0266
BBI-0348, BBE-0266, BBE-0216, BBE-0329 and BBI-0338 can also be used as parental material suiting to both the seasons	

Bivoltine and Multivoltine silkworm germplasm accessions selected through Hot spot evaluation	
Abiotic/biotic stress condition	Accessions identified
High temperature and high humidity (autumn conditions)	BBE-0266, BBE-0178 (for Jammu and Sahaspur) BBE-0198, BBE-0266 (for less disease incidence)
High temperature and low humidity (abiotic)	BMI-0045, BMI-0025, BMI-0027, BMI-0060
High temperature and high humidity (abiotic)	BMI-0040, BMI-0025, BMI-0027, BMI-0016
High temperature and high humidity (biotic)	BMI-0027

Registration of silkworm host plants / silkworm breeds

In order to protect the IPR rights of the breeders and to give due credit to the breeding institutes, CSGRC, Hosur is doing registration of silkworm host plants / silkworm breeds following standard protocols and after recommendation by the registration committee. The list of host plant registered are presented below:

LIST OF HOST PLANTS REGISTERED		
Year	**Institute**	**Host plants**
2002	CSRTI, Berhampore	S-1,S1635,TR-10,BC259,S799,C1730
2002	CMERTI, Lahdoigarh	SOM MT 01- 08 (Muga)
2004	KSSRDI,Thalaghattapura	VISWA,Vishala,TG
2005	CSRTI, Mysore	S-30,S-36,S-41,S-54,V-1,S-13,S-34,RFS-135,RFS-175,GN0-2,G-No-54,AR-11,AR-12,K2 X Kosen,RC-1,RC-2, K-2 Tetraploid,S-36 Tetraploid,S-41 Tetraploid,RFS-135 Tetraploid,V-1 Tetraploid,S-13 Tetraploid,S-34 Tetraploid
2009	CSGRC, Hosur	Kanva 2 x Lamia Bay(MI-0608) Urgam 2 X Urgam -4(MI-0646), Doomarhalli x Lamia Bay (MI-0673), Baragarh-2 x Lamia Bay (MI-0828), Kajili x M.Serrata (MI-0832), Krishnaswamy-2 x Lamia bay (MI-0833)
	Total	**46**

LIST OF SILKWORM BREEDS REGISTERED		
Year	**Institute**	**Silkworm breeds**
2002	CSRTI, Berhampore	YB,SK-6, SK-3,SK-7,SK-4
2004	APSSRDI, Hindupur	APM-1(MV), APS-5,APS-4,APS-9,APS-8(BV)
2004	KSSRDI,Thalaghattapura	NP-2,NP-4,NP-5,KSO-2,KSO-3,HDO,HND,NK-1,NK-2,NK-3,DD-1,DD-2,DD-3(BV), SLKSPM(MV)
2004	CSRTI, Mysore	CSR-2,CSR-3,CSR-4,CSR-5,CSR-6,CSR-12,CSR-16,CSR-17,CSR-18,CSR-19(BV)MY1,P2D1,RD-1,BL-23,BL-24,BL-43(MV)
2009	KSSRDI,Thalaghattapura	MH-1 (MV),SLWu-8(BV)
2012	SSTL, Kodathi	PM(M)
	Total	**43**

Digital herbarium of Mulberry Germplasm

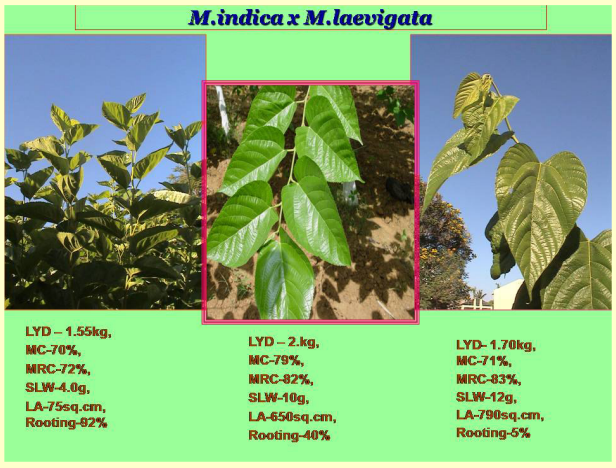

MI-0569


MI-0247


MI-0417

Pre-breeding in Mulberry germplasm

- The narrow genetic base of present popular high yielding mulberry varieties coupled with low utilization of genetic resources may limit future mulberry production and productivity due to climate change.
- Wild species with enhanced levels of resistance/tolerance to multiple stresses provide important sources of genetic diversity for crop improvement. However, their exploitation for cultivar improvement is limited by cross-incompatibility barriers and linkage drags.
- Pre-breeding provides a unique opportunity, through the introgression of desirable genes from wild germplasm into genetic backgrounds readily used by the breeders with minimum linkage drag.
- Among the four species of *Morus* reported in India, *M. indica* and *M. alba* were cultivated for silkworm rearing and are closely related genetically.
- Among the four species, *M. laevigata* possess unique features of large leaf, long inflorescence, long fruit, and high timber value and also adapted to wider agro-climatic regions.
- The leaves of *M. serrata* are common source of fodder and the wood is used for preparation of agricultural appliances, sports goods. Silkworm feeding trails showed leaves are acceptable to silkworms.
- Efforts were made at CSGRC through interspecific hybridization utilizing wild *Morus* species such as *Morus laevigata* and *Morus serrata* with cultivated species like *Morus indica* and *Morus alba*. At present 27 accessions are available in the mulberry *ex situ* field gene bank.



Pre-breeding in Multivoltine silkworm germplasm

- PM and Nistari are only two proven races for CB production
- Bivoltine characters brought into the MV parental breeds resulting in hibernation and segregation at later stages etc.
- ICB breeds with 2A - 4A grade silk are very much required in the field.
- Highly productive races need not be better combiners.
- Therefore, all the 77 MV accessions were crossed with CSR-2 and the hybrid performance was evaluated and promising hybrid combinations were identified based on the rearing and post cocoon traits using Mano's Evaluation Index.

MV hybrid combinations better than popular hybrids

Particulars	Better than Pure Mysore Hybrid		Better than Nistari Hybrid	
Traits	Range	Nos.	Range	Nos.
Wt. of 10 grown larvae (g)	35.3 - 27.4	54	35.3 - 35.3	1
ERR by (no.)	9900 - 9766	13	9900 - 9700	22
ERR by wt. (Kg)	15.95 - 13.35	8	15.95 - 12.7	12
Pupation rate (%)	96.3 - 94.6	8	96.3 - 93	17
Single cocoon weight (g)	1.46 - 1.30	24	1.46 - 1.26	34
Single shell weight (g)	0.301 - 0.242	53	0.30 - 0.24	48
Shell ratio (%)	22.8 - 18.5	73	22.8 - 19.4	60
Average Filament Length (m)	851.7 - 590.3	72	851.8 - 647.1	61
Non Broken Filament Length (m)	851.7 - 543.0	71	851.8 - 542.5	71
Denier	1.89 - 2.51	56	1.89 - 2.76	75

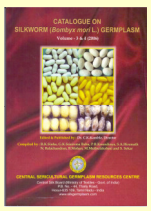
Promising MV accessions as parental breeds

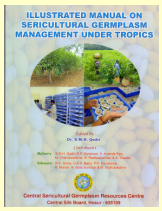
Cocoon colour	Nos.	Accession No.
Greenish Yellow	5	BMI-077, BMI-032, BMI-073, BMI-042, BMI-010
Chrome Yellow	5	BMI-025, BMI-021, BMI-031, BMI-028, BMI-053
White	2	BMI-030, BMI-061
Off white	1	BMI-074

Publication

- Five catalogues on mulberry and three on silkworm germplasm were published incorporating details on the morphological, reproductive and economical parameters of **1078** mulberry and **431** silkworm germplasm. It is available in electronic form also.
- Illustrated Manual on Sericultural Germplasm manangemnt under Tropics
- Laboratory Working manual on the procedure for identification of Protein and DNA profiles in Silkworm Genetic Resources
- Monograph on Mulberry (*Morus spp.*)
- In-house publication includes Annual reports and half yearly News Letters.
- Proceedings of different workshops and seminars have also been published by the centre for reference.
- The centre has published 260 research papers, 67 popular articles and 29 technical reports besides 267 papers were presented in various workshops / seminars

CSGRC website (www.csgrc.res.in)





Other Services

- Well characterized and evaluated mulberry and silkworm germplasm are supplied to the scientists to work on crop improvement programme and also to other needy users to promote utilization.
- Centre is providing training to the scientists involved in the germplasm management and the sericultural farmers.
- In order to give due recognition to the scientists and also popularize the varieties/breeds evolved by them, centre is doing registration of the germplasm.
- Centre is extending facilities to the students of M.Sc. and Ph.D in terms of laboratory and expertise to guide them to work on different aspects of germplasm management for their research thesis.


BSCIC
CERTIFICATE OF REGISTRATION

QUALITY MANAGEMENT SYSTEM

This is to certify that:
CENTRAL SERICULTURAL GERMPLASM RESOURCES CENTRE
CENTRAL SILK BOARD
MINISTRY OF TEXTILES, GOVT. OF INDIA
P.B. NO. 44, THALLY ROAD, HOSUR – 635 109
TAMIL NADU, INDIA

Hereby granted the Certificate Number : BN9864/8944:0814

Subsequent to the assessment conducted on 27-Jul-2014 and the organization has been found to be operating a Quality Management System which complies with the requirements of

ISO 9001:2008
for the following scope :

Provision of Conservation, Characterization, Evaluation and Supply of Mulberry and Silkworm Germplasm, Database Maintenance, Research Activities and Administration

Originally Registered: 06 Aug 2014 Latest issue: 06 Aug 2014 Expiry Date: 05 Aug 2017

For BSCIC CERTIFICATIONS PVT.LTD.

Page 1 of 1

Sanjay Seth
Managing Director

Validity of this Certificate is subject to Annual Surveillance Audits to be done Successfully on or before 27-Jul-2015 and 27-Jul-2016 resp.

(In case if Surveillance Audit is not allowed to be conducted; this Certificate shall be Suspended/Withdrawn).

BSCIC
ISO 9001 REGISTERED

Budget

Year	Amount (in lakhs)
2010-11	365.18
2011-12	382.53
2012-13	395.87
2013-14	487.19
2014-15	471.78

Edited and compiled by
Dr. A. Ananda Rao, Shri N. Balachandran, Dr.K.Jhansi Lakshmi, Smt. M. Muthulakshmi, S. Sekar and P.B.V. Shankar

Published by
Dr. P.K. Mishra, Director
Central Sericultural Germplasm Resources Centre, Hosur – 635 109