Directory of Completed Sericulture Projects and Sericulture Experts of India

Part III

Directory of Sericulture Technologies

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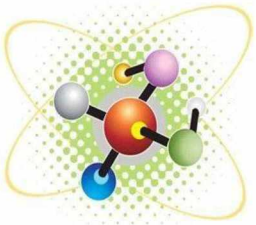

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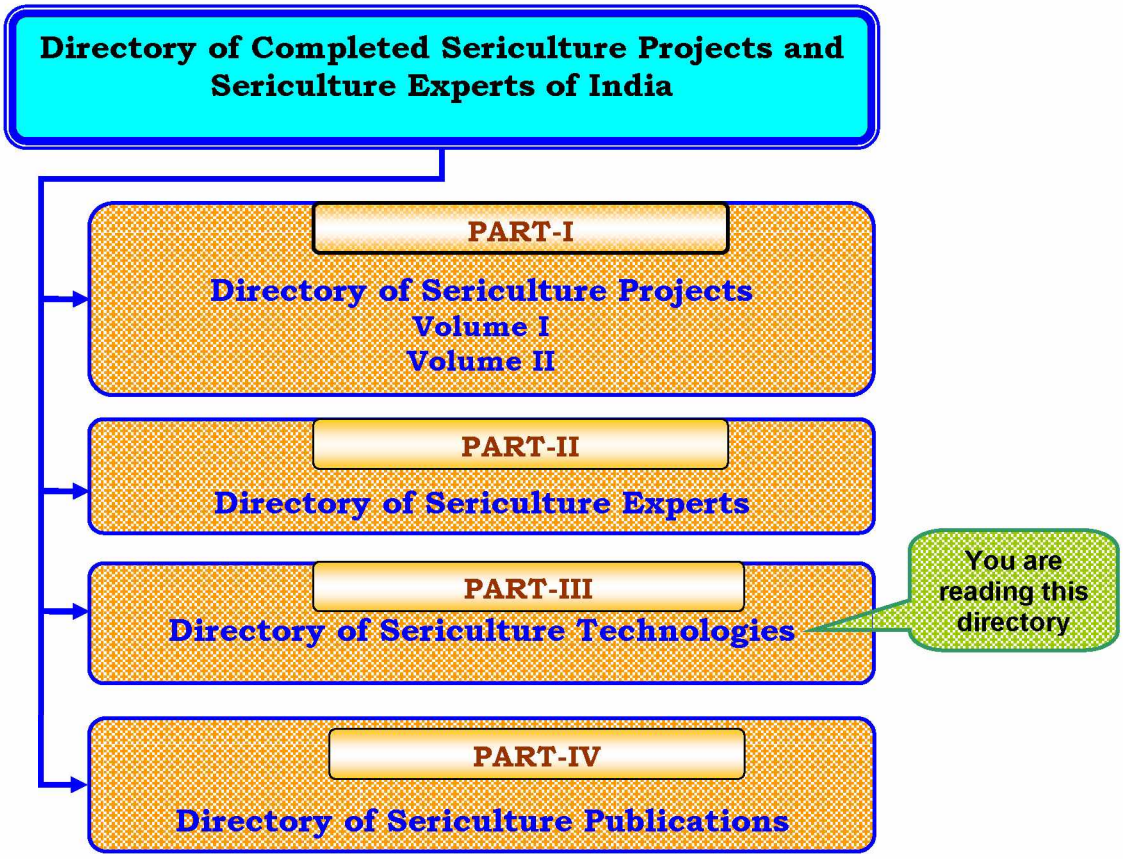
E. Muniraju

FLOW CHART OF THE DIRECTORIES



EXECUTIVE SUMMARY

A Project entitled, *'Preparation of Directory of Completed Sericulture Projects and Sericulture Experts of India'*, sponsored by Department of Science and Technology, Government of India, New Delhi, was implemented at Karnataka State Sericulture Research and Development Institute, Thalaghattapura, Bangalore during 2005-2008 with an objective to bring out comprehensive directories on the Sericulture Research Projects implemented, Experts working in the field of Sericulture, Technologies Developed and Publications brought out. Periodical guidelines were sought from the Local Project Advisory Committee (LPAC) during the project period in addition to a mid term appraisal workshop. The brief outcome of the resourced information is given below.

As envisaged in the project the directories are brought out in four parts, namely ;

Part I : Directory of Sericulture Projects (Vol. I & II)
Part II : Directory of Sericulture Experts
Part III : Directory of Sericulture Technologies and
Part IV : Directory of Sericulture Publications

Part III : Directory of Sericulture Technologies :

- The directory contains the sericulture technologies recommended by leading sericulture institutes, universities and colleges.
- Information of 524 technologies has been documented in this directory.
- Classification of technologies grouped as 140 mulberry, 244 silkworm, 53 silk technology, 59 non-mulberry and 28 for sericulture engineering and others.
- CSR&TI, Mysore has recommended 161 technologies followed by KSSRDI (109), CMERTI (31), CSR&TI, Berhampore (32), CSR&TI, Pampore (32), CSTRI, Bangalore (32), CTRTI, Ranchi (41) and others (88).
- Mainly 10 institutes and 10 universities have contributed for sericulture technological development of the country.
- Subject Index is given at the end of the directory.
- Directory information is also made available in the search option CD to be provided along with this directory and also on public domain website kssrdi.org.
- List of institute wise patented/commercialized technologies is given.
- List of authorized mulberry varieties and silkworm races is also given at the end of the directory.
- Silkworm seed production norms has been given at the end of the directory.

CHAPTER I

INTRODUCTION

'Sericulture' is an art and science of rearing of silkworms to produce cocoons and silk. This activity, apart from the rearing of silkworms, also involves growing of mulberry leaf the only feed for silkworms, reeling of silk yarn from cocoons, weaving the silk yarn and further processing it to produce the silk fabric. There are many more ancillary activities encompassing the sericulture activity, such as silkworm egg production, fabrication of rearing appliances, production of organic manures, development of irrigation methods, fabrication of garden machineries, waste silk units, byproduct utilization units etc. Silk is the natural textile fibre and accounts for 0.2% of the textiles in the world. Though accounting for a meager quantity in textile sector, silk attracts the user by its glamour, elegance, richness and beauty. The production of raw silk and silk fabrics are limited to only a few countries in the world of which China occupies the first place and India, the second. Other countries such as Japan, Russia and countries of former USSR, Korea, Iran, Thailand, Vietnam, Brazil, Turkey, Bulgaria, Yugoslavia also contribute to the world silk production. Silk goods from India are exported to major countries like USA, Germany, UK, Italy, France, Spain, Canada, Australia Switzerland, Greece, Netherlands, UAE, Belgium, Denmark, Austria, Portugal and few others. There has been a strong market for the silk and silk goods in the International level. The demand for silk goods is expected to exist as long as the human race appreciates its wearing.

Sericulture is an important means for the socio-economic development of the rural masses and provides an ideal opportunity for developing countries having a major rural sector. It is a highly labour intensive, profit oriented, low input indoor activity that gives frequent periodicity of economic returns. It is also well suited for the women folk of rural sector. An acre of irrigated mulberry provides employment to 5 persons throughout the year and earns net returns of around Rs. 60,000/- per year which is substantial compared to other similar crops. It also provides major occupation for the moisture deficit tracts of rainfed agriculture in the tropics.

Indian sericulture industry : Sericulture in India is unique by itself producing all the four varieties of silk namely Mulberry and Vanya (Tasar, Eri and Muga) silks. Of the four varieties of silk produced, mulberry silk accounts for 91% and the balance is shared by other varieties. Mulberry raw silk is produced mainly in the states of Karnataka, Andhra Pradesh, Tamil Nadu in the tropical zone and West Bengal and Jammu and Kashmir in the sub-tropical and temperate zones and these are called the traditional states. These five states account for nearly 98.7% of the total mulberry raw silk production of the country. Out of the five traditional states producing mulberry raw silk, Karnataka is in the forefront contributing 56.8% to the raw silk production of the country. The second position is occupied by the state of Andhra Pradesh contributing 28.9% of raw silk.

India is producing about 15,000 metric tones of raw silk annually, creating employment to over 6 million people directly and indirectly. India is again unique in the silk consumption process. About 80% of the total production is consumed locally. The traditional pattern of dress, weaving and the raw silk consumption for manufacture of these fabrics, contribute for the bulk utilization. Hence there is sufficient domestic market for the silk produced in the country. India is earning foreign exchange of over Rs.2000 cores annually. Further efforts are being made to produce bivoltine raw silk of export quality for transaction in the International raw silk market.

It is to be mentioned here that at the global level India is the only country which is steadily increasing its production of raw silk year by year. Other countries have recorded a declining trend. With this situation the demand and supply gap will increase and thus India has a good opportunity to expand the Industry and produce more and more silk to reduce this gap and to make a dent in the world raw silk market.

Indian sericulture research : Research is a basic requirement and is continuous process for the development of any industry and it is so for sericulture. Central and State sector Research

Institutes (Fig.1) have largely contributed for sericultural development through several technologies evolved during the last few decades.
Major focus of research is given to labour reduction, yield and quality improvement programmes of mulberry leaf production, silkworm rearing and post-cocoon sectors. Continuous efforts in research have contributed for developing few high yielding mulberry varieties with improved nutrition. High productive bivoltine and multivoltine silkworm races have also been evolved to replace the old low yielding local races. Technologies related to mulberry cultivation, silkworm rearing and disease and pest management have also been vital for increased production.

Despite implementation of many research projects in sericulture, no compiled information on the projects and findings is lacking at the State or at the Central Govt. level as a document. This is a drawback for further planning and development of the industry. The present project is aimed at documentation of these projects details in well compiled form and hence the proposal.

A number of research and extension projects have been implemented for the development of sericulture industry in India. The research findings have contributed a great deal for sericulture development in the form of higher productivity and quality. Over the past three decades the production of cocoons/unit quantity of seed has trebled while the mulberry leaf production per hectare has doubled. All these have been made possible due to technological inputs resulted from intensive research and extension programmes/projects implemented in the country.

In addition to State and Central Government organizations various voluntary and co-operative groups, non-governmental organizations (NGO's), self help groups, corporate sectors and multinational organizations have been actively involved in sericulture related developmental programmes during the last two decades or so. The proposed document will be useful for such organizations to get the state of the art technical know-how from the concerned subject experts.

The need of the project : A number of Research, Development and Extension related projects have so far been implemented in India. These research findings have contributed a great deal for the development of sericulture industry in India and elsewhere towards the improvement in quality and productivity. However, the details of these projects in a compiled form are not available either at the regional level or at the national level. Hence, the project was envisaged.

Objectives :

i. To compile and bring out a consolidated directory of completed sericulture projects in India with relevant details (Part-I);

ii. To bring out a consolidated profile of Planners, Scientists and Extension personnel involved in the national progress of sericulture industry (Part-II);

iii. To compile and bring out a consolidated report on the sericulture technologies evolved in India (Part-III);

iv. To bring out a consolidated information on the literature published on the sericulture related research work carried out in India, in the form of a directory (Part IV);

v. To bring out the directory in the form of book (hard copy), in CD (soft copy) and to launch the directory in the internet (e-copy).

CHAPTER II

METHODOLOGY

To resource the information on sericulture technologies evolved in India, a questionnaire (Format 3a, Annexure-II) was developed based on the suggestions by the Local Project Advisory Committee (LPAC) and approved by the DST. Nodal Project Coordinators were identified with the help of Heads of different Institutions/Departments and were trained for collecting the information from the available sources in the respective Institutions of the country. In addition, the printed formats for collection of data were dispatched to all the agencies involved in sericulture research, along with the covering letter explaining the objective and scope of the directory with a request to return the completed format to the Investigator and to circulate the format among colleagues. The Principal Investigator traveled extensively throughout the country and met the Heads of the organizations and requested them to provide the technology information developed by the respective institutes. The format was made available in the Institute's KSSRDI website www. kssrdi.org. This was followed-up through regular phone calls.

The directory is brought out in four parts, namely,

Part-I: Directory of Sericulture Projects (Vol. I & II)
Part-II: Directory of Sericulture Experts
Part-III: Directory of Sericulture Technologies and
Part-IV: Directory of Sericulture Literature

In the present directory, the objectives (iii) and (v) of the directory as given inthe previous chapter, are covered.

Source of Information : The information was resourced from

- Central Sericulture Agencies: The CSB, and its Mulberry silk and VANYA silk related Institutes
- State Sericulture Agencies : State Research Institutes like KSSRDI, APSSRDI and KSSRDI
- Universities and Colleges and
- NGO's

Type of data :

i) Primary data : The data collected by the following sources was classified as primary data :

- Interaction with the Institutes
- Downloading from websites
- Personal interaction

ii) Secondary data : The secondary data was collected from

- Annual reports of research organizations
- Annual reports of funding agencies
- Published literature

Classification of data : The data on number of technologies were classified based on the organizations and subjects and presented in Table 1.

Table 1. Organization and subject-wise classification of the technology information.

Sl. No.	Name of the Institute/Organization	Technologies					
		Mulberry	Mulberry Silkworm	Silk Technology	Non-Mulberry	Machinery and equipments	Total
1	Andhra Pradesh State Sericulture Research & Development Institute, Hindupur	---	10	---	---	---	10
2	Avinashilingam Institute for Home Science and Higher Education, Coimbatore	---	1	---	---	---	1
3	BAIF Institute for Rural Development, Tiptur	1	2	---	---	---	3
4	Central Muga, Eri Research and Training Institute, Jorhat	4	4	7	16		31
5	Central Sericultural Germplasm Resources Centre, Hosur	---	2	---	---	---	2
6	Central Sericultural Research & Training Institute, Berhampore	15	15	---	---	---	30
7	Central Sericultural Research & Training Institute, Mysore	60	78	--	---	23	161
8	Central Sericultural Research & Training Institute, Pampore	17	15	---	---	---	32
9	Central Silk Technological Research Institute, Bangalore	---	---	32	---	---	32
10	Central Tasar Research and Training Institute, Ranchi	----	---	3	38	--	41
11	Dayananda Sagar College of Engineering, Bangalore	---	---	---	---	2	2
12	Department of Sericulture (Govt. of Andhra Pradesh, Karnataka, Tamil Nadu)	3	6	---	---	---	9
13	Dr. Babasaheb Ambedkar Marthwada University, Aurangabad	---	1	---	---	---	1
14	Kakatiya University, Warangal	1	---	---	---	---	1
15	Karnatak University, Dharwad	---	1	---	---	---	1
16	Karnataka State Sericulture Research & Development Institute, Bangalore	23	67	19	---	---	109
17	National Silkworm Seed Organization, Bangalore	---	2	---	---	---	2
18	Sher-e-Kashmir University of Agricultural Science & Technology, Srinagar	1		---	---	---	1
19	Silkworm Seed Technology Laboratory, Bangalore	1	17	---	--	3	21
20	Tamil Nadu Agriculture University, Coimbatore	3	4	---	---	---	7
21	University of Agricultural Sciences, Bangalore	9	1	---	---	---	10
22	University of Mysore, Mysore	---	5	---	---	---	5
23	Viswabharathi University, Santiniketan	1		---	---	---	1
24	Others	1	10	---	---	---	11
	Total	140	241	61	54	28	524

CHAPTER III

ABOUT THE DIRECTORY

The directory is a repository or database of information. A directory, as opposed to a conventional database, is heavily optimized for reading.

Definitions :

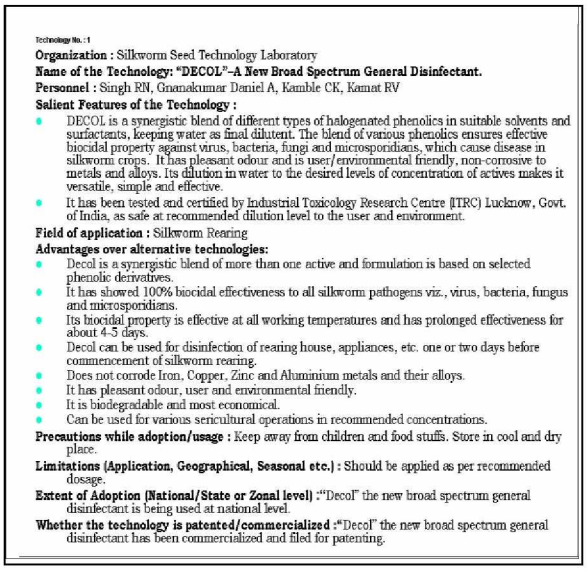
Directory : The directory is the reservoir of information about a particular subject that generally would not be considered harmful or an invasion of privacy or loss if disclosed otherwise it should be useful to a community (www.wikipedia.com).

The technology : There are various definitions available in the Internet. More or less they mean the same. (www.wikipedia.com)

- "Technology" is the practical application of science to commerce or industry.
- "Technology" is the use of science to develop new products or new methods for producing and distributing goods and services.
- "Technology" is the application of scientific or other organized knowledge including any tool, technique, product, process, method, organization or system to practical tasks.
- "Technology" is the application of scientific advances to benefit humanity.

How to use the directory : The layout of the information is given in Fig.1.

Fig.1. Sample image of the Technology information.



Technology No. : 1

Organization : Silkworm Seed Technology Laboratory

Name of the Technology: "DECOL"–A New Broad Spectrum General Disinfectant.

Personnel : Singh RN, Gnanakumar Daniel A, Kamble CK, Kamat RV

Salient Features of the Technology :

- DECOL is a synergistic blend of different types of halogenated phenolics in suitable solvents and surfactants, keeping water as final dilutent. The blend of various phenolics ensures effective biocidal property against virus, bacteria, fungi and microsporidians, which cause disease in silkworm crops. It has pleasant odour and is user/environmental friendly, non-corrosive to metals and alloys. Its dilution in water to the desired levels of concentration of actives makes it versatile, simple and effective.
- It has been tested and certified by Industrial Toxicology Research Centre (ITRC) Lucknow, Govt. of India, as safe at recommended dilution level to the user and environment.

Field of application : Silkworm Rearing

Advantages over alternative technologies:

- Decol is a synergistic blend of more than one active and formulation is based on selected phenolic derivatives.
- It has showed 100% biocidal effectiveness to all silkworm pathogens viz., virus, bacteria, fungus and microsporidians.
- Its biocidal property is effective at all working temperatures and has prolonged effectiveness for about 4-5 days.
- Decol can be used for disinfection of rearing house, appliances, etc. one or two days before commencement of silkworm rearing.
- Does not corrode Iron, Copper, Zinc and Aluminium metals and their alloys.
- It has pleasant odour, user and environmental friendly.
- It is biodegradable and most economical.
- Can be used for various sericultural operations in recommended concentrations.

Precautions while adoption/usage : Keep away from children and food stuffs. Store in cool and dry place.

Limitations (Application, Geographical, Seasonal etc.) : Should be applied as per recommended dosage.

Extent of Adoption (National/State or Zonal level) : "Decol" the new broad spectrum general disinfectant is being used at national level.

Whether the technology is patented/commercialized : "Decol" the new broad spectrum general disinfectant has been commercialized and filed for patenting.

Taking decision as to whether a particular "item" is a technology or not, is entirely left to the discretion of the institution which has developed it. All the research outcomes, which have been recommended by the institutions, as technologies are included in this directory. The technologies that are recommended by the institutes but not included in the official list of "Technologies developed by the Institution" are also included in this directory.

Analysis

The directory contains the recommended sericulture technologies of leading sericulture institutes, universities and colleges. Information on 524 technologies have been documented in this directory, from 31 organizations. In this section, analysis has been done on the basis of technologies developed in Central and State organizations, Universities and Colleges, Departments of Sericulture of different states and also the Non-Government Organizations (NGO). Subject-wise, analysis is also done considering the different disciplines in each subject.

1. Technologies developed in different categories of organizations : Of the 524 technologies developed (Fig-1), 351 technologies (66.98%) were developed by the major Central Institutions, 120 technologies (22.90%) were developed by State Government Research and Development Institutions, 30 technologies (5.73%) were developed by Universities and colleges, 14 technologies (2.67%) were developed by Non-Government and private entrepreneurs and 9 technologies (1.72%) were developed by Departments of Sericulture of different States.

Fig-1 :Technologies developed by different categories of Institutions.

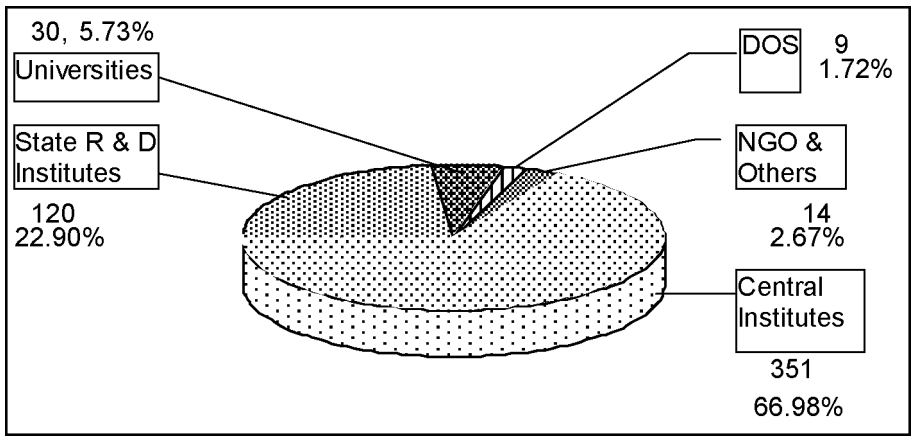
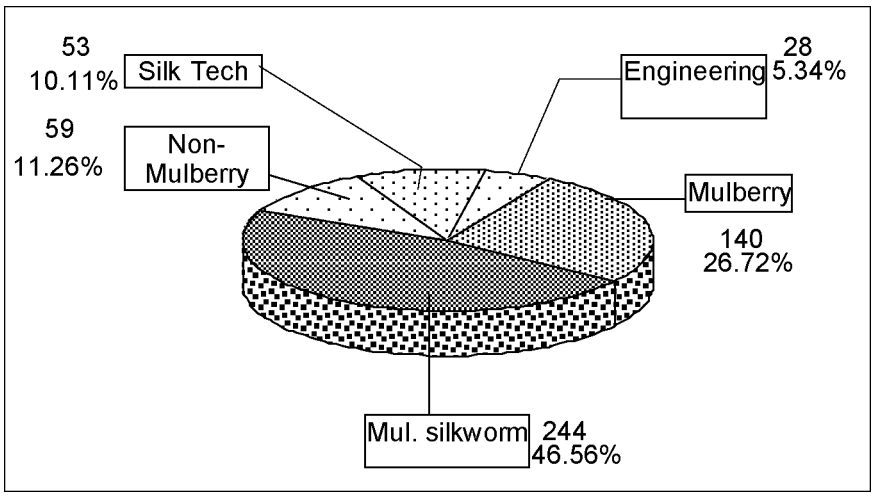
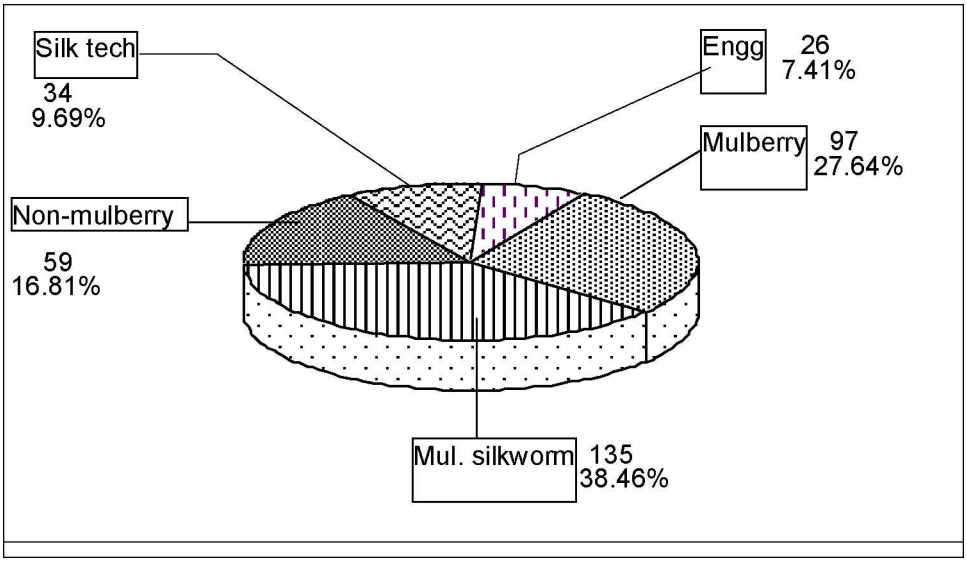


Fig-2 : Sericulture technologies developed in India under different disciplines



(i) Central research institutes:

Fig-3 : Technologies developed in different subjects by Central Research

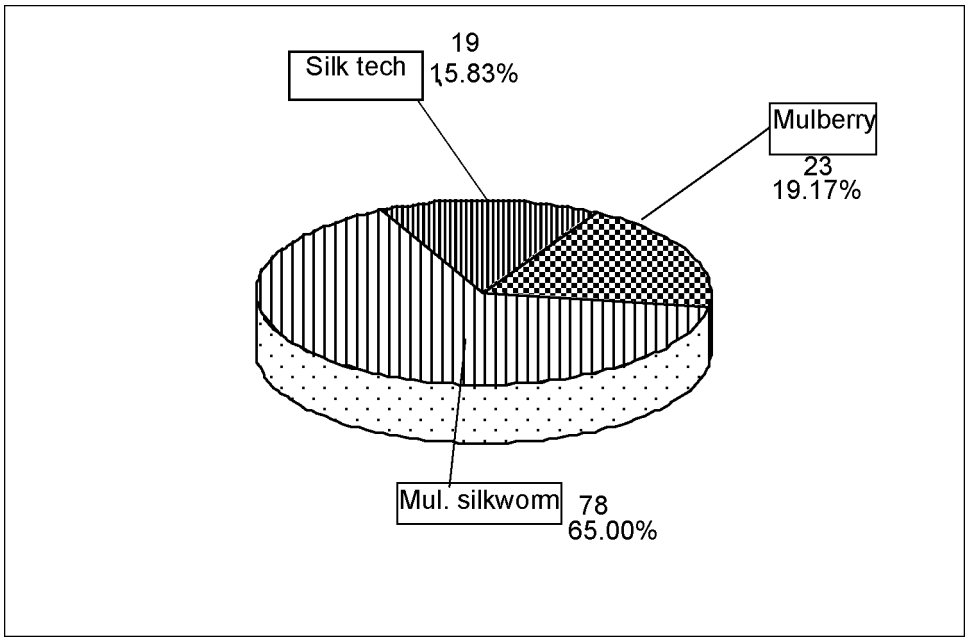


2. Classification based on organization and discipline : Of the 524 technologies developed in India (Fig-2), 140 technologies (26.72%) are mulberry related technologies, 244 technologies (46.56%) are mulberry silkworm related, 59 technologies (11.26%) are non-mulberry related, 53 technologies (10.11%) are on Silk Technology and 28 technologies (5.34%) are Engineering related technologies
(Fig. 2). These technologies are developed by different organizations as detailed below.

Out of 351 technologies developed by the Central Research Institutions, 135 mulberry silkworm related technologies (38.46%) have been developed by 7 Institutes, 97 mulberry host plant related technologies (27.64%) have been developed by 5 Institutes, 59 non-mulberry silkworm related technologies (16.81%) have been developed by 2 Institutes, 34 post-cocoon technologies (9.69%) have been developed by 3 Institutes and 26 sericulture engineering related technologies (7.41%) have been developed by 2 Institutes.

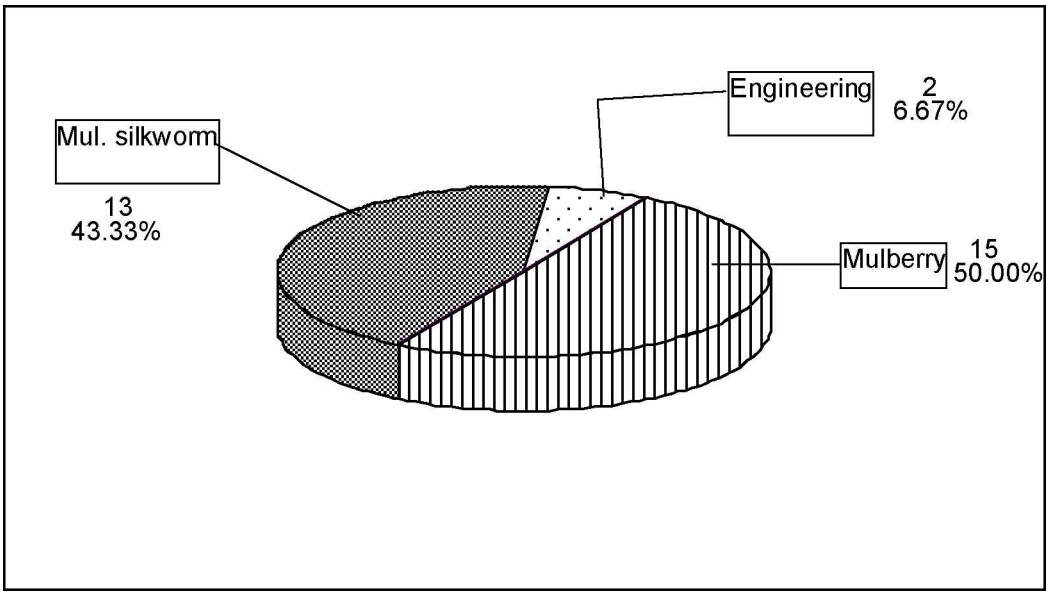
(ii) State research institutes : State Sericulture Research Institutes have developed 120 technologies (22.90%). Karnataka State Sericulture Research and Development Institute (KSSRDI) and Andhra Pradesh State Sericulture Research and Development Institute (APSSRDI) are the only two State Government Research Institutes in India involved exclusively in sericulture research. Of the 120 technologies, 78 mulberry silkworm related technologies (65.00%) (Fig-4), 23 mulberry related technologies (19.17%) and 19 Silk technology related technologies (15.83%) have been developed by these Institutes.

Fig-4 : Technologies developed by State Research Institutes in various disciplines



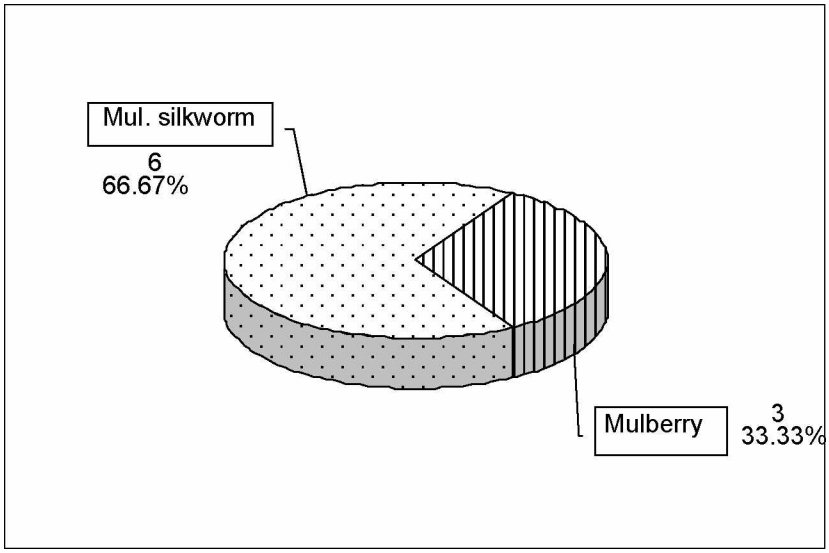
(iii) Universities and colleges : Nine Universities and colleges have contributed for sericulture technology development and out of the total 524 technologies documented, 30 technologies (5.73%) were developed by Universities and Colleges. Out of these, 15 mulberry plant related (50.00%) (Fig-5), 13 mulberry silkworm related (43.33%) and 2 non-mulberry silkworm related technologies (6.67%).

Fig-5 : Technologies developed in different subjects by universities and colleges



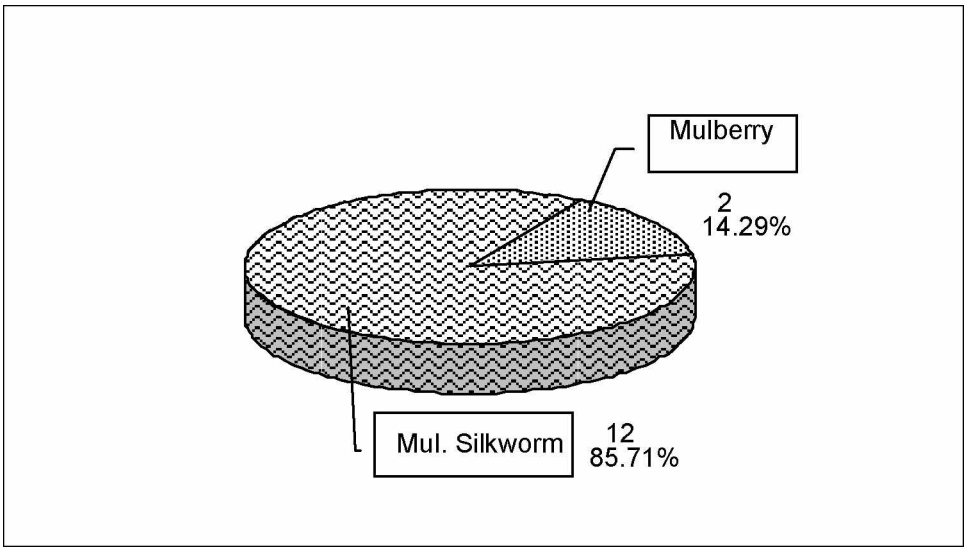
(iv) State government departments of sericulture : 9 technologies (1.72%) (Fig-1), out of the 524 technologies, were developed by the Departments of Sericulture governed by different State Governments. Andhra Pradesh, Karnataka and Tamil Nadu have their Departments of Sericulture (Table-3). Of the 9 technologies, 6 mulberry silkworm related technologies (66.67%) (Fig-6) and 3 mulberry host plant related technologies (33.33%) have been developed by these three Departments.

Fig-6 : Technologies developed in different subjects by State Government Departments



(v) Non-Government organizations : There are 7 Non-Government Organizations (Table-5) which were involved in sericulture and 14 technologies (2.67%) (Fig-1) were developed by them. Out of these, 12 are mulberry silkworm related technologies (85.71%) (Fig-7) and 2 are mulberry plant related technologies (14.29%).

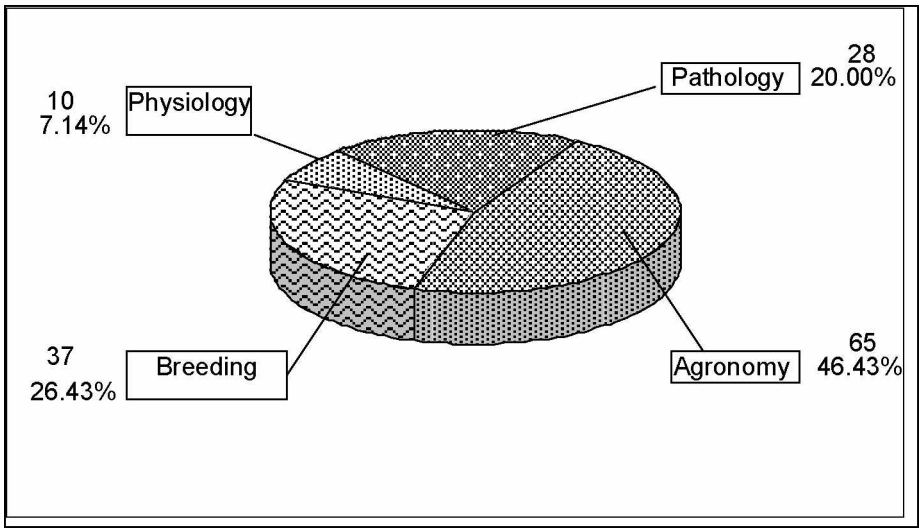
Fig-7 : Technologies developed in different subjects by Non-Government Organizations



3. Technologies developed in different subjects :

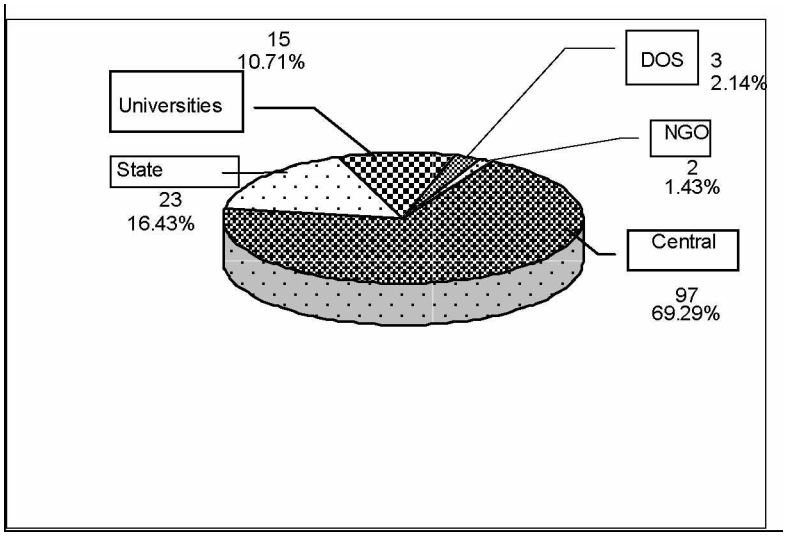
(i) Mulberry host plant : Out of the 524 technologies, 140 technologies (26.87%) (Fig-2) related to the mulberry plant, were developed by different organizations. Of these, 65 technologies (46.43%) (Fig-8) were on agronomy, 37 technologies (26.43%) were on mulberry breeding, 28 technologies (20.00%) were on mulberry pathology and 10 technologies (7.14%) were on mulberry physiology (Fig. 8).

Fig-8 : Technologies developed in different branches of mulberry subject



Of 140 mulberry technologies, 97 technologies (69.29%) (Fig-9, Table-1) were developed by Central Research Institutes, 23 (16.43%) were developed by State Institutes (Fig-9, Table-2), 15 technologies (10.71%) were developed by Universities and Colleges (Fig-9, Table-3), 3 technologies (2.14%) were developed by Department of Sericulture of different States (Fig-9, Table-4) and 2 technologies (1.43%) were developed by Non-Government Organizations (Fig-9, Table-1).

Fig-9 : Technologies developed in mulberry subject by different organizations.



Tables 1 to 5 give the details pertinent to the technologies developed in mulberry subject by Central Research Institutions, State Research Institution, Universities and Colleges, State Government Departments of Sericulture and NGOs respectively.

Table-1. Technologies developed by Central Institutions under different disciplines of mulberry

Sl. No.	Organization	Mulberry Technologies (No.)			
		Agronomy	Breeding	Physiology	Pathology

1	Central Muga, Eri Research and Training Institute, Jorhat	2	---	---	2
2	Central Sericultural Research & Training Institute, Berhampore	7	3	---	5
3	Central Sericultural Research & Training Institute, Mysore	29	16	5	10
4	Central Sericultural Research & Training Institute, Pampore	14	2	---	1
5	Silkworm Seed Technology Laboratory, Bangalore	1	---	---	---
	Sub-Total	53	21	5	18
	Total	97			

Table-2. Technologies developed by State Institutions under different disciplines of mulberry

Sl. No.	Organization	Agronomy	Breeding	Physiology	Pathology
1	Karnataka State Sericulture Research & Development Institute, Bangalore	3	13	2	5
	Total	**23**			

Table-3. Sericulture technologies developed by universities and colleges

Sl. No.	Organization	Mulberry	Mulberry Silkworm	Sericulture Engineering
1	Avinashilingam Institute for Home Science and Higher Education, Coimbatore	---	1	---
2	Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	---	1	---
3	Dayananda Sagar College of Engineering, Bangalore	---	---	2
4	Kakatiya University, Warangal	1	---	---
5	Karnatak University, Dharwad	---	1	---
6	Shere-e-Kashmir University of Agricultural Sciences and Technology, Srinagar	1	---	---
7	Tamil Nadu Agricultural University, Coimbatore	3	4	--
8	University of Agricultural Sciences, Bangalore	9	1	---
9	University of Mysore, Mysore	---	5	---
10	Viswabharathi University, Santiniketan	1	---	---
	Sub-Total	**15**	**13**	**2**
	Grand Total	**30**		

Table-4: Sericulture technologies developed by State sericulture departments

Sl. No.	Organization	Mulberry	Silkworm
1	Department of Sericulture, Andhra Pradesh	---	1
2	Department of Sericulture, Karnataka	2	4
3	Department of Sericulture, Tamil Nadu	1	1
	Total	**9**	

Table-5. Sericulture technologies developed by NGOs and Private entrepreneurs

Sl. No.	Organization	Mulberry	Silkworm
1	BAIF, Tumkur, Karnataka	1	2
2	Asian catalyst, Bangalore	---	1
3	Growel formulations	---	1
4	Lakshmi Industries, Indore	---	1
5	Nandi Agrovet, Bangalore	---	4
6	Sericare Technologies, Bangalore	---	3
7	Vennar Organics	1	---
	Sub-Total	2	12
	Grand Total	14	

(ii) Mulberry silkworm : 244 technologies (46.56%) out of the 524 technologies were developed in mulberry silkworm subject by different organizations. Of these, 70 technologies (28.69%) (Fig-10) were on silkworm breeding, 60 technologies (24.59%) were on silkworm pathology, 43 technologies (17.62%) were on silkworm rearing technology, 36 technologies (14.75%) were on silkworm seed technology, 32 technologies (13.11%) were on entomology and 3 technologies (1.23%) were on silkworm physiology.

Fig-10 : Technologies developed in different branches of mulberry silkworm subject.

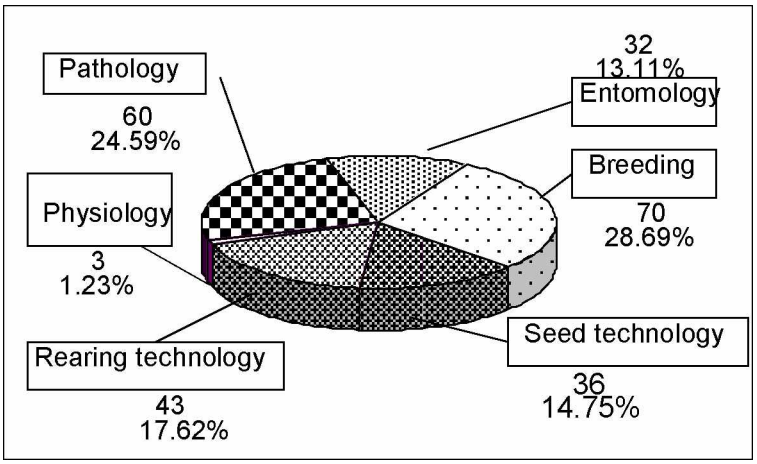


Fig-11 : Technologies developed in mulberry silkworm subject by different organizations

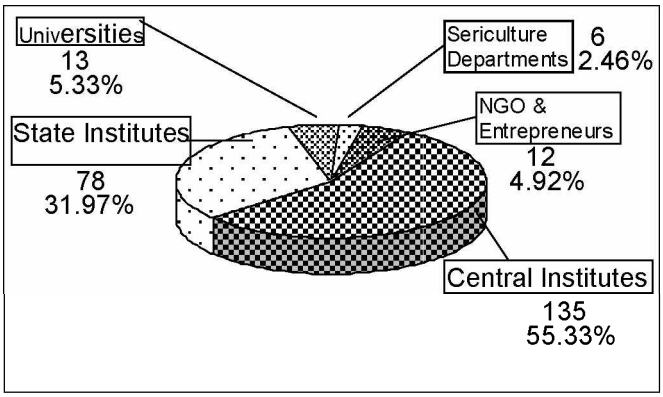


Table-6. Technologies developed by Central Institutions under different disciplines of mulberry silkworm

Sl. No.	Organization	Silkworm Related Technologies					
		Breeding	Rearing	Physiology	Seed Tech.	Pathology	Entomology
1	Central Muga, Eri Research and Training Institute, Jorhat	---	1	---	2	1	---
2	Central Sericultural Research & Training Institute, Berhampore	2	3	---	2	3	5
3	Central Sericulture Germplasm Resource Centre, Hosur	---	---	---	2	1	---
4	Central Sericultural Research & Training Institute, Mysore	34	15	2	3	12	13
5	Central Sericultural Research & Training Institute, Pampore	8	6	---	---	1	---
6	National Silkworm Seed Organization, Bangalore	---	---		2	---	---
7	Silkworm Seed Technology Laboratory, Bangalore	---	2	---	13	2	---
	Sub-Total	44	27	2	24	20	18
	Total	135					

Table-7. Technologies developed by State Institutions under different disciplines of mulberry silkworm

Sl. No.	Organization	Breeding	Rearing	Physiology	Seed Tech.	Pathology	Entomology
1	Andhra Pradesh State Sericulture Research and Development Institute, Hindupur	5	---	---	---	5	---
2	Karnataka State Sericulture Research & Development Institute, Bangalore	9	15	1	12	21	10
		14	15	1	12	26	10
	Total	78					

135 out of 244 technologies (55.33%) (Fig-11, Table-6) were developed on mulberry silkworm by Central Research Institutes, 78 (31.97%) were developed by State level Institutes (Fig-11, Table-7), 13 technologies (5.33%) by Universities and colleges (Fig-11, Table-3), 6 technologies (2.46%) by Department of Sericulture of different States (Fig-11, Table-4) and 14 technologies (4.92%) by Non-Government Organizations (Fig-11, Table-5).

(iii) Non-mulberry silkworm : 59 technologies (11.26%) (Fig-2), out of the 524 technologies were developed on non-mulberry subject (Tasar, Eri and Muga). Only two central research institutes namely, CMERTI, Jorhat and CTRTI, Ranchi have worked on non-mulberry silkworm. 41 technologies (69.49%) (Fig-12) were on Tasar, 12 technologies (20.34%) were on muga and 6 technologies (10.17%) were on eri silkworm.

Fig-12 : Technologies developed in non-mulberry sericulture (Tasar, Eri and Muga)

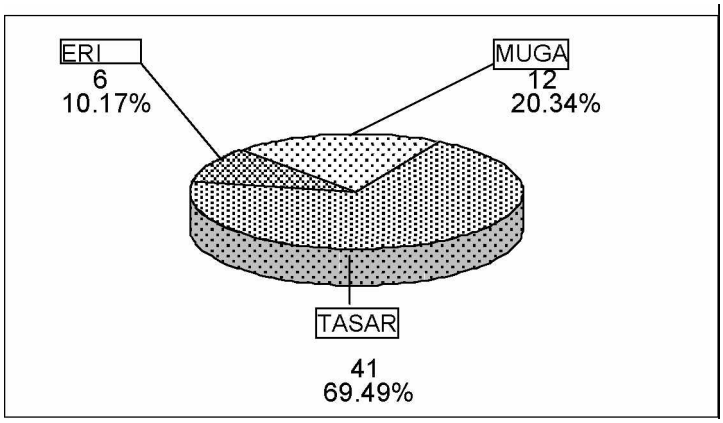
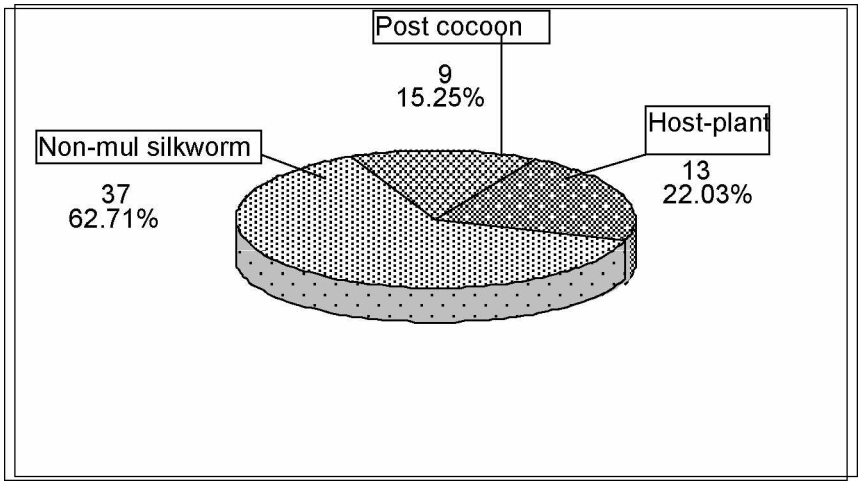


Fig-13 : Technologies developed in different subjects of non-mulberry sericulture



Among them, 13 technologies (22.03%) were on host-food plants (Fig-13, Table-8), 37 technologies (62.71%) were on non-mulberry silkworm aspects (Fig-13, Table-9), and 9 technologies (15.25%) were on post cocoon technology of non-mulberry silk (Fig-13, Table-10).

Table-8. Technologies developed on non-mulberry host food plant

Sl. No	Organization	Tasar Culture	Eri Culture	Muga Culture
1	Central Muga Eri Research and Training Institute, Jorhat	---	1	4
2	Central Tasar Research and Training Institute, Ranchi	8	---	---
Total		13		

Table-9. Technologies developed on non-mulberry silkworm

Sl. No	Organization	Tasar Culture	Eri Culture	Muga Culture
1	Central Muga Eri Research and Training Institute, Jorhat	---	3	4
2	Central Tasar Research and Training Institute, Ranchi	30	---	---
Total		37		

Table-10. Technologies developed in the post-cocoon sector of non-mulberry

Sl. No	Organization	Tasar Culture	Eri Culture	Muga Culture
1	Central Muga Eri Research and Training Institute, Jorhat	---	2	4
2	Central Tasar Research and Training Institute, Ranchi	3	---	---
Total		9		

(iv) Silk Technology : 53 technologies (10.11%), out of the 524 technologies were developed in silk technology. Three central research institutes have developed 34 technologies (64.15%) (Fig-15, Table-11) and KSSRDI, Bangalore (State Institute) has developed 19 technologies (35.85%) (Fig-14, Table-11). Out of 53 technologies, 10 technologies (62.71%) (Fig-15) were on wet processing, 29 technologies (22.02%) were on silk reeling and 14 technologies (15.25%) were on silk weaving.

Fig-14: Technologies developed by Central and State Institutions

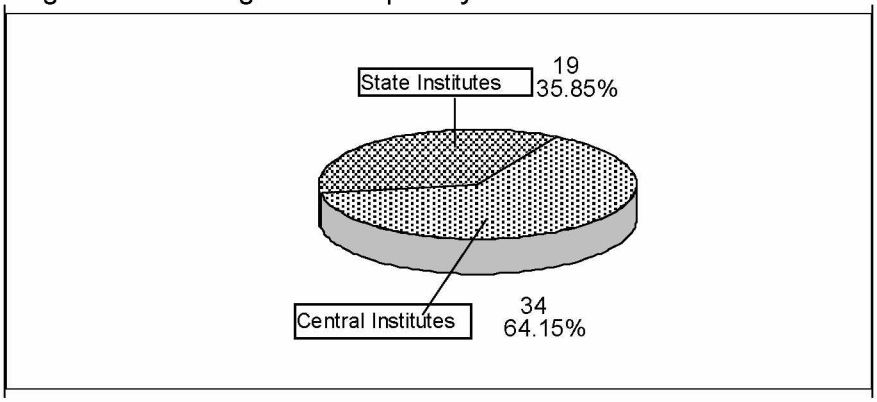


Fig-15 : Silk technology aspects under different subjects

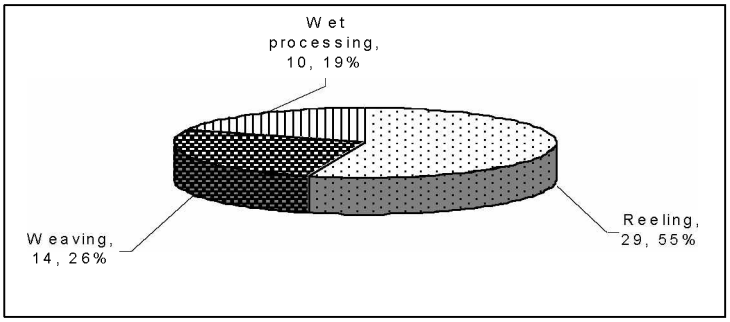


Table-11. Technologies developed by the organizations in the post-cocoon sector

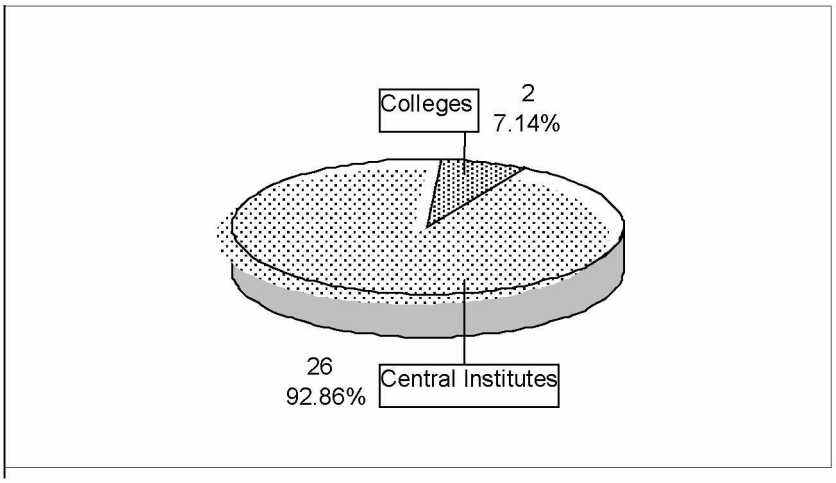
Sl. No.	Organization	Silk reeling	Wet processing	Weaving	Total
1	Central Muga Eri Research and Training Institute, Jorhat	1	---	---	1
2	Central Sericultural Research and Training Institute, Mysore	1	---	---	1
3	Central Silk Technological Research Institute, Bangalore	15	6	11	32
4	Karnataka State Sericulture Research & Development Institute, Bangalore	12	4	3	19
Total		29	10	14	53

(v) Sericulture engineering : 28 technologies (5.34%) (Fig-2), out of the 524 technologies were developed in Sericulture Engineering. Two Central Research Institutes have developed 26 technologies (64.15%) (Fig-16, Table-13) and Dayananda Sagar College, Bangalore has developed 2 technologies (7.14%) (Fig-16, Table-3). These Engineering technologies are mainly in aid of mulberry production and harvest, egg production and silkworm rearing. In Dayananda Sagar college of Engineering, the technologies developed were as project work for the students.

Table-12. Technologies developed under sericulture engineering

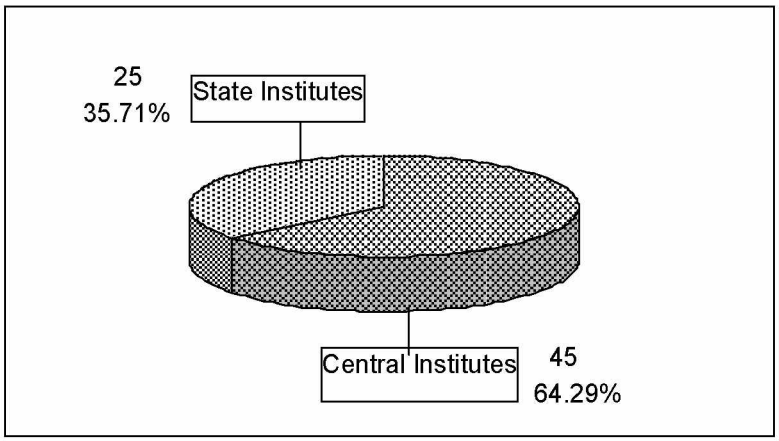
Sl. No.	Organization	Engi. Tech.
1	Central Sericultural Research and Training Institute, Mysore	23
2	Silkworm Seed Technology Laboratory Bangalore	3
3	Dayananda Sagar College of Engineering, Bangalore	2
	Total	28

Fig-16: Technologies developed by Central Institutes and Colleges



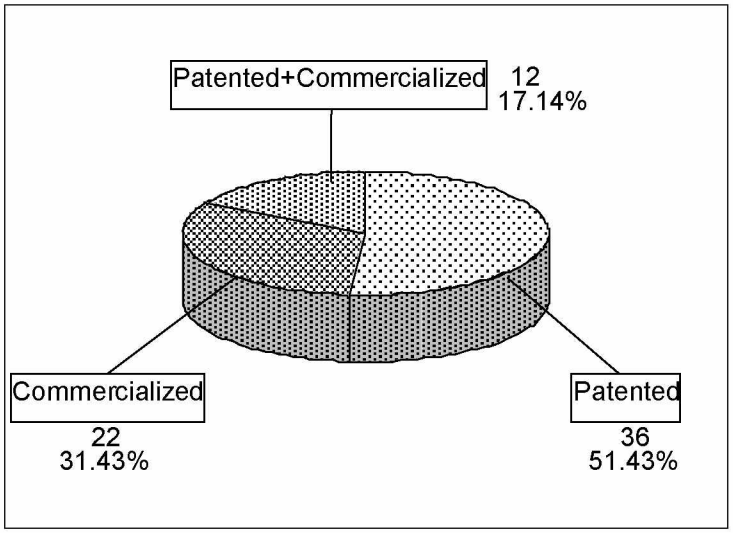
4. Patented and commercialized technologies : In the past, research institutes developed the technologies and released them for the benefit of end users. However, in recent years, the developed technologies were being processed for patenting or for commercialization. Out of 524 technologies, 70 technologies were patented/commercialized by 7 central and 2 state institutes (Fig. 17). By law, silkworm races and mulberry varieties can not be patented; however, they could be authorized for commercial use.

Fig-17. Patented and commercialized technologies of Central and State institutes



Out of 70 technologies, 36 (51.43%) technologies (Fig-18, Table-14) are patented and 22 technologies (31.43%) are commercialized, while 12 technologies (17.14%) are patented and commercialized.

Fig-18. Patented and commercialized technologies in sericulture

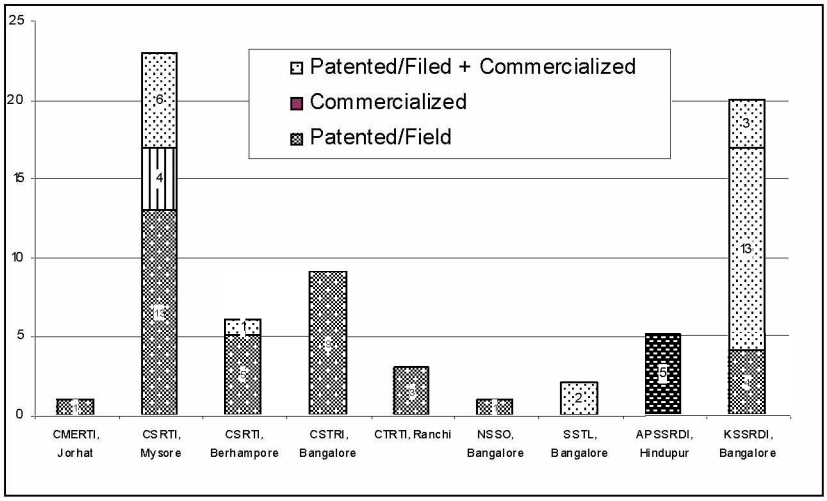


CSRTI. Mysore has the largest number of patented technologies (19), while KSSRDI, Bangalore has largest number of commercialized (21) technologies (Fig-19, Table-14).

Table-14. Patented/commercialized sericulture technologies by different Institutions

Sl. No.	Institutions	Technologies			
		Patented/ Filed	Commercialized	Patented/Filed Commercialized	Total
Central Institutes					
1	CMERTI, Jorhat	1	---	---	1
2	CSRTI, Mysore	13	4	6	23
3	CSRTI, Berhampore	5	---	1	6
4	CSTRI, Bangalore	9	---	---	9
5	CTRTI, Ranchi	3	---	---	3
6	NSSO, Bangalore	1	---	---	1
7	SSTL, Bangalore	---	---	2	2
Sub-Total (Central Institutes)		32	4	9	45
State Institutes					
1	APSSRDI, Hindupur	---	5	---	5
2	KSSRDI, Bangalore	4	13	3	20
Sub-Total (State Institutes)		4	18	3	25
Total		36	22	12	70

Fig-19. Patented and commercialized technologies of different Institutes



Subject-wise patenting details : Details of the number of patents in different subjects by different Institutions are given in the Fig-20 and Table-15. Highest number of the technologies (20 technologies, 28.6%) are patented/filed for patenting in silkworm pathology subject. Subject–wise number of patents/commercialized products are as follows (percentage is given in the parenthesis): Post-cocoon technologies–10 (14.3%), Silkworm Rearing-8 (11.4%), Mulberry Pathology, Seed technology and Silkworm Rearing-5 each (7.14%), Agronomy-4 (5.71%), Mulberry production, Entomology and By-Product utilization-3 (4.29%), Silkworm Physiology-2 (2.86%), Non-mulberry host-plant and Sericulture Engineering-1 each (1.43%).

Fig-20. Patented/patent filed, commercialized technologies in different subjects

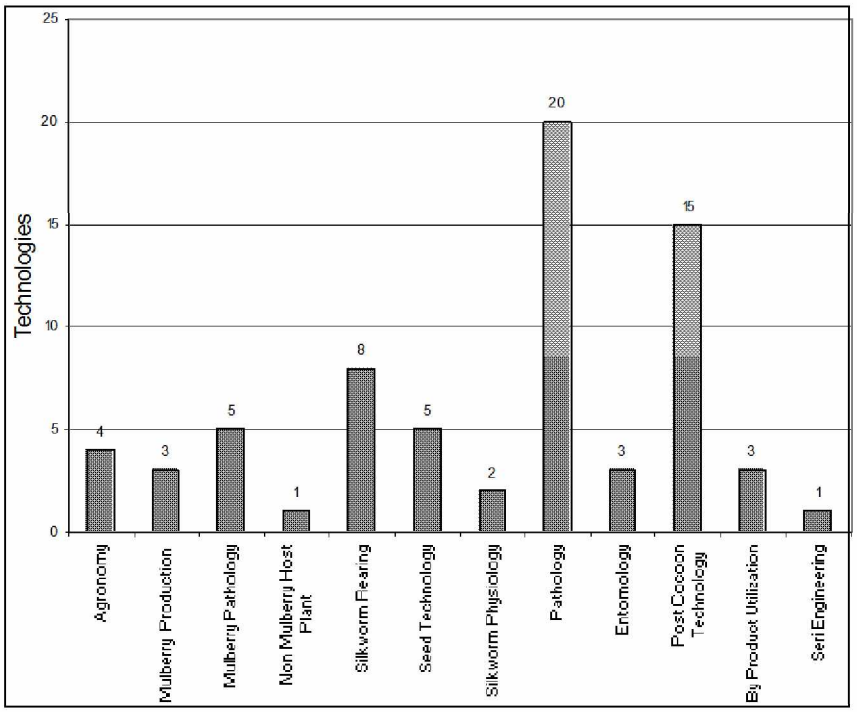


Table-15. Subject-wise patented/commercialized technologies of different Institutions

Sl. No	Institutions	Agronomy	Mulberry Production	Mulberry Pathology	Non Mulberry	Silkworm Rearing	Seed Technology	Silkworm Physiology	Pathology	Entomology	Post Cocoon Technology	By Product	Seri	Total
Central Institutions														
1	CMERTI, Jorhat	--	--	--	--	--	--	--	--	--	1	--	--	1
2	CSRTI, Mysore	2	2	2	--	5		1	5	1	2	2	1	23
3	CSRTI, Berhampore	--	--	1	--	1	1		1	1	---	1	--	6
4	CSTRI, Bangalore	--	--	--	--	--	--	--	--	--	9	--	--	9
5	CTRTI, Ranchi	--	--	--	1	1	1	--	--	--	--	--	--	3
6	NSSO, Bangalore	--	--	--	--	--	1	--	--	--	--	--	--	1
7	SSTL, Bangalore	--	--	--	--	--	--	--	2	--	--	--	--	2
Sub Total (Central Institutes)		2	2	3	1	7	3	1	8	2	12	3	1	45
State Institutes														
1	APSSRDI,	--	--	--	--	1	1	--	3	--	--	--	--	5

	Hindupur													
2	KSSRDI, Bangalore	2	1	2	--	--	1	1	9	1	3	--	--	20
Sub Total (State Institutes)		2	1	2	--	1	2	1	12	1	3	--	--	25
	Total	4	3	5	1	8	5	2	20	3	15	3	1	70

Limitations : There were many limitations in compiling the heterogeneous data to a common format. While doing so, some modifications were introduced without changing the content of the data. The difficulties faced were;

- Poor response from the Organizational Heads/Project Investigators.
- Non-availability of complete information in respective libraries.
- Non-availability of uniform data as per the format.
- Non-availability of technology information report in the respective organizations.
- Non-availability of experimental data and photographs for most of the technologies.

An Appeal

The Investigating team is very glad to place on record their sincere gratitude to all those who co-operated and provided the information to make this Directory meaningful. In spite of the difficult task by the investigating team, by a conservative estimate, the information available is only partial. Still there is a scope for incorporating the information in the subsequent updates of the data. To be able to do so, the co-operation of the technology developers/scientists/researchers is required. Any person who feels that some more information can be added or the available information be edited/updated, please visit the website www.kssrdi.org , download the Format and send the complete information to the Principal Investigator through e-mail (emuniraju@yahoo.com) giving the details.

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