Final Report

Authorization Trial of silkworm hybrids in Eastern and North-Eastern India (AIB:3531)

July 2014 - June 2015

Silkworm Breeding and Genetics Section

Central Sericultural Research and Training Institute,
Central Silk Board, Ministry of Textiles,
Berhampore, W.B.

i. **Project code and title** : AIB:3531: Authorization Trial of silkworm hybrids in Eastern and North-Eastern India

ii. **Names of the Project Investigators** : 1) Dr.A.K.Verma, PI
2) Dr .N. Suresh Kumar CI
3) Dr. A. K. Saha

iii. Duration (Date of Start) - (Scheduled Date of Completion)

Date of start : July 2014
Date of completion : June 2015

iv. Name(s) of the Institute(s) and Address : Central Sericultural Research & Training Institute, Berhampore, PIN-742101 Dist.- Murshidabad, West Bengal, India

v. A list of Objectives / Goals : The main objective of the project is to test the hybrids with the farmers of Eastern and North-Eastern India for its authorization

vi. Introduction

In India, silkworm hybrids have been continuously developed and made available for commercial exploitation by many breeders all over India. However, acceptance of new hybrids by the industry depends on its suitability to a particular region or season and its performance over the ruling race/ hybrid. Therefore, to assess the productivity of silkworm hybrids and to judge their suitability to regions/ seasons, hybrids developed by the breeders are being subjected to a system of tests and subsequent authorization for wider popularization in commercial sericulture industry. Authorization of silkworm breeds grants recognition to silkworm breeds for commercial exploitation. It gives authenticity to the organization or the breeder who developed the hybrid a right to popularize the same in the field along with other authorized hybrids. Therefore, there is an urgent need to test these new hybrids with the farmers in the various climatic zones in the Eastern & North Eastern part of India under the administrative and technical control of CSR&TI, Berhampore to find out the suitability of these hybrids for authorization.

vii. Methodology Adopted

- The RSRSs, RECs and respective DOSs identified the farmers in their jurisdiction for implementing the programme as per the three different schemes.

- National Silkworm Seed Organization, Bangalore to produce the quantum of testing material to the respective tests centers through its Silkworm Seed Production Centers.
- The quantum of the DFLs of Multi x Multi, Multi x Bi and Bi x Bi were distributed among them as per their capacity of the sericulture farmers and seasons as depicted in the two different schemes
- The DFLs were supplied free of cost as per plan.
- Disinfectants were supplied to the farmers free of cost.
- Training was given to all the farmers who are involved in the programme
- Field day were conducted after completion of each crop
- Resham Krishi Mela was conducted for the benefit of the farmers involved in the programme.
- Study materials in the form of pamphlets were printed in the respective local languages and distributed to the farmers.
- The respective officer in-charge of the RSRSs and RECs will monitor the crop during the rearing of the hybrids with the farmers of their jurisdiction.
- Collection of the rearing data through tests centers of the rearing performance of the particular hybrid at the farmers level alongwith the meteorological data during the entire rearing period.
- Three kg cocoons each from three farmers of respective areas were purchased and sent to SCTH Malda, West Bengal for assessment of post-cocoon parameter
- The reeled silk of each hybrid were subjected for assessment of post cocoon parameters .
- Feed back data from individual sericulture farmers, seed production units and reelers were collected on the specific format during the programme period.
- The generated data were analysed for identification of region and season specific hybrids for its authorization

Hybrid materials selected for this programme

The newly developed hybrids developed by CSRTI, Berhampore which were found promising at laboratory level are being considered as hybrid materials for the said programme. The hybrids which have been selected is depicted in the Table 1.

Table 1: Selected silkworm hybrids for post authorization trial in the Eastern and North-Eastern zone

Table 1a: Scheme-I : Bi x Bi hybrids

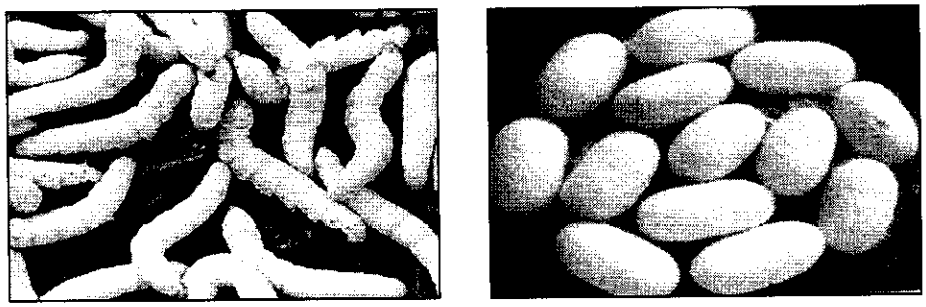
Crop	Hybrid
Falguni (Spring)	B.Con.1 x B.Con.4 SK6 x SK7
Agrahayani (Autunm)	B.Con.1 x B.Con.4 SK6 x SK7

Table 1b: Scheme-II: Multi x Bi hybrids

Crop	Hybrid
Falguni (Spring)	M6DPC x (SK6 x SK7) Nistari x (SK6 x SK7)
Baishaki (Early Summer)	M6DPC x (SK6 x SK7) Nistari x (SK6 x SK7)
Agrahayani (Autunm)	M6DPC x (SK6 x SK7) Nistari x (SK6 x SK7)

Salient features of selected hybrids

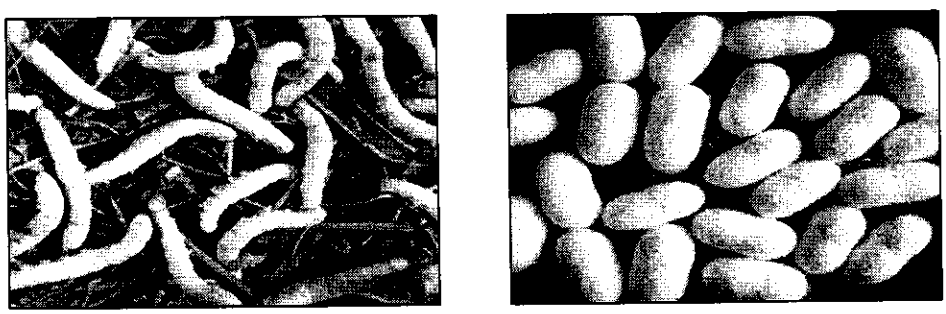
B.Con.1 x B.Con.4



Larvae and cocoons of B.Con.1 x B.Con.4

Parameters	Values
Shell percentage (%)	19.0-20
Filament length (m)	850-900
Renditta	6.5-7.0
Yield/100 dfls (kg)	50.0-55.0
Rearing condition	Temp.24-26°C;Humidity 75-80%(October- March)

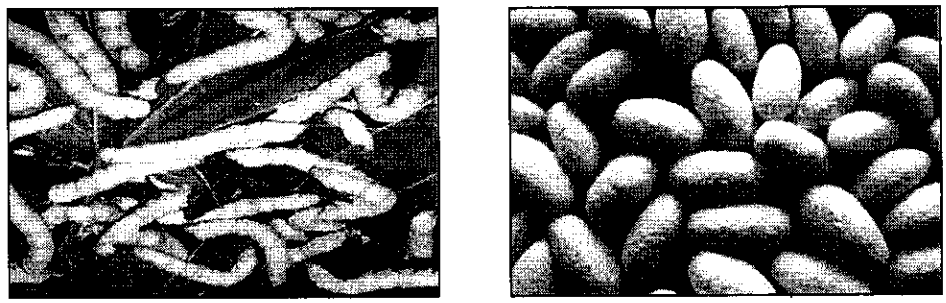
SK6 x SK7



Larvae and cocoons of SK6 x SK7

Parameters	Season	
	Unfavourable	Favourable
Fecundity	473	525
Pupation rate (%)	70.50	90.50
Yield/10000Larvae(weight.)	10.100	14.600
Cocoon Weight.(g)	1.316	1.613
Shell percentage (%)	17.30	18.90
Filament length (m)	748	830

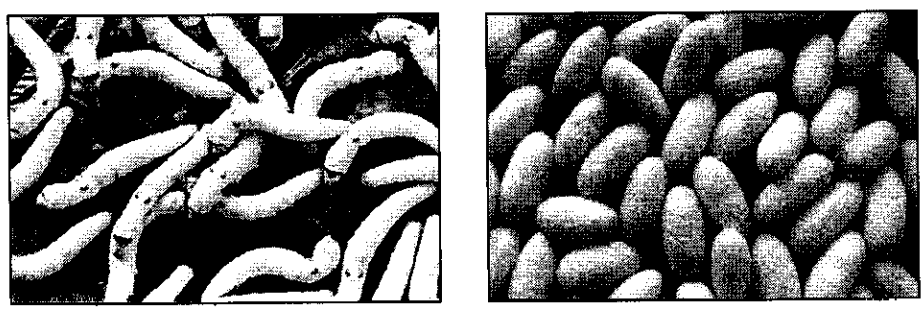
M6DPC x (SK6 x SK7)



Larvae and cocoons of M6DPC x (SK6 x SK7)

Parameters	Values
Shell percentage (%)	16.5-17.5
Filament length (m)	650-700
Renditta	9.0-9.5
Yield/100 dfls (kg)	50.0-60.0
Rearing condition	Temp.25-31°C;Humidity 75-80% (October- April)

Nistari x (SK6 x SK7)



Larvae and cocoons of Nistari x (SK6 x SK7)

Parameters	Values
Shell percentage (%)	15.5-16.0
Filament length (m)	600-650
Renditta	8.5-9.0
Yield/100 dfls (kg)	48.0-55.0
Rearing condition	Temp.25-31°C;Humidity 75-80%(October- April)

viii. Observations / Results duly indicating the output in terms of adding to knowledge; know-how / new packages/ practices / processes /products / innovations developed and their utility and advantages; etc.,

Results

Rearing performance in East and North-Eastern regions:

AIB:3531 : The project entitled "Authorization trials of silkworm hybrids in Eastern and North-Eastern India" was completed as per the mile stone. The bivoltine hybrid., B.Con.1 x B.Con.4 with SK6 x SK7 as control and the multivoltine x bivoltine hybrid, M6DPC x (SK6 x SK7) with Nistari x (SK6 x SK7) as control were tested with the farmers of West Bengal, Jharkhand, Odisha, Chattisgargh, Manipur, Assam, Meghalaya, Mizoram, Nagaland and Sikkim for one year covering all the commercial crops of the respective states.

Autumn/Agrahayani 2014

In North-Eastern states, 2800 dfls of B.Con.1 x B.Con.4 and 700 dfls of SK6 x SK7 were tested during Autumn 2014 with farmers and recorded an average yield of 44.92 kg/100 dfls. (Table 1). During Aghrayani, 2014 crop 28800 dfls of M6DPC x (SK6 x SK7) and 6700 dfls of Nistari x (SK6 x Sk7) was tested in West Bengal and Jharkhand states and recorded an average yield of 50.06 kg/100 dfls and 47.25 kg/100 dfls, respectively. (Table 2).). Besides, 3200 dfls of B.Con.1 x B.con.4 and 800 dfls of SK6 x SK7 were tested in West Bengal and Jharkhand states during Aghrayani, 2014 crop and recorded an average yield of 56.94 kg/100 dfls and 55.14 kg/100 dfls, respectively (Table 3). In Odisha , a quantity of 1200 dfls of B.Con.1 x B.con.4 and 300 dfls of SK6 x SK7 were tested during Autumn 2014 and recorded an average yield of 46.4 kg/100 dfls and 42.73 kg/100 dfls, respectively (Table 4).

Table 1. Performance of bivoltine hybrids under Authorization Trial (AIB:3531) (Autumn Crop '14)

Unit	Target	Hybrids			
		B.Con.1 x B.Con.4		SK6 x SK7	
		Quantity	Yield/100 dfls (kg)	Quantity	Yield/100 dfls (kg)
RSRSJorhat	1000	800	44.25	200	41.96
REC,Agartala	500	400	56.58	100	55.20
REC,Aizawl	500	400	48.54	100	46.50
REC,Imphal	500	400	47.65	100	45.60
REC,Shillong	500	400	48.53	100	41.75
REC, Rangpo	500	400	43.52	100	38.50
Total/Avg.	**3500**	**2800**	**48.18**	**700**	**44.92**

Table 2. Performance of multivoltine x bivoltine hybrids in West Bengal and Jharkhand under Authorization Trial of silkworm hybrids (Autumn Crop '14)

Unit	Target	Hybrids			
		M6DPC x (SK6 x SK7)		Nistari x (SK6 x SK7)	
		Quantity	Yield/100 dfls (kg)	Quantity	Yield/100 dfls (kg)
REC, Mothabari	6000	5000	47.52	1000	44.53
REC, Maheshpur Raj	500	400	50.12	100	48.36
REC, Kamnagar	6000	5000	58.75	1000	55.50
REC, Rajmahal	2000	1600	50.15	400	47.42
DoT(Seri), Malda	6000	5000	48.38	1000	45.00
DoT(Seri), Birbhum	4000	3000	47.85	1000	45.00
DoT(Seri), MSD	6000	5000	50.21	1000	48.00
DoT (Seri), Nadia	1000	800	52.17	200	49.00
ZSSO, Malda	4000	3000	45.36	1000	42.40
Total/Avg.	**35500**	**28800**	**50.06**	**6700**	**47.25**

Table 3. Performance of bivoltine hybrids in West Bengal and Jharkhand under Authorization Trial of silkworm hybrids (Autumn Crop '14

Unit	Target	Hybrids			
		B.Con.1 x B.Con.4		SK6 x SK7	
		Quantity	Yield/100 dfls (kg)	Quantity	Yield/100 dfls (kg)
REC, Mothabari	500	400	49.65	100	48.43
REC, Maheshpur Raj	500	400	58.65	100	56.49
REC, Kamnagar	500	400	60.12	100	57.70
REC, Rajmahal	500	400	59.65	100	56.40
ZSSO, Malda	2000	1600	56.65	400	52.40
Total/Avg.	**4000**	**3200**	**56.94**	**800**	**55.14**

Table 4. Performance of bivoltine hybrids in Odisha under Authorization Trial of silkworm hybrids (Autumn Crop '14)

Unit	Target	Hybrids			
		B.Con.1 x B.Con.4		SK6 x SK7	
		Quantity	Yield/100 dfls (kg)	Quantity	Yield/100 dfls (kg)
RSRS, Koraput	500	400	45.2	100	40.0
REC, Deogargh	500	400	47.5	100	43.2
REC, Bademaringa	500	400	46.5	100	45.0
Total/Avg.	**1500**	**1200**	**46.4**	**300**	**42.73**

Spring/Falguni 2015

During Falguni 2015, 39800 dfls of M6DPC x (SK6 x SK7) was tested with the farmers of West Bengal and Jharkhand with an average yield of 50.8 kg/100 dfls as against 47.3 kg/100 dfls recorded for 10200 dfls of Nisatari x (SK6 x Sk7) (Table 5). Besides, 3200 dfls of B.Con.1 x B.Con.4 was tested with an average yield of 49.5 kg/100 dfls as against 47.2 kg/100 dfls recorded for 800 dfls of Sk6 x SK7 (Table 6).

In north-eastern states, 2800 dfls of B.Con.1 x B.Con.4 was tested with the farmers and recorded an average yield 0f 4.4 kg/100 dfls as against 44.2 kg/100 dfls recorded for 700 dfls of SK6 x SK7 (Table 7).

Table 5.Performance of multi x bi hybrids during Falguni/Spring crop 2015

Centre	Hybrids			
	M6DPC x (SK6 x SK7)		Nistari x (SK6 x SK7)	
	Quantity	Yield/100 dfls	Quantity	Yield/100 dfls
REC,Kamnagar	6000	56.1	2000	53.0
REC,Mothabari	6000	55.0	2000	45.0
REC, Rajmahal	1600	49.0	400	48.0
REC, M.P. Raj	400	49.6	100	45.4
DoT(Seri) Malda	6000	53.0	2000	44.0
DoT(Seri),Birbhum	8000	48.5	--	--
DoT(Seri) , MSD	5000	56.0	2000	53.0
DoT(Seri),Nadia	1200	54.0	300	45.0
ZSSO, Malda	4800	42.0	1200	44.7
REC, Bhandra	400	32.8	100	31.4
REC, Gumla	400	39.8	100	37.3
Total/Average	**39800**	**50.8**	**10200**	**47.3**

Table 6.Performance of bi x bi hybrids during Falguni/Spring 2015

Centre	Hybrids			
	B.Con.1 x B.Con.4		SK6 x SK7	
	Quantity	Yield/100 dfls	Quantity	Yield/100 dfls
REC,Kamnagar	400	59.0	100	56.1
REC,Mothabari	400	58.0	100	55.0
REC, Rajmahal	400	56.0	100	48.0
REC, M.P. Raj	400	51.8	100	43.3
ZSSO, Malda	800	44.3	200	48.7
REC, Deogargh	400	54.0	100	52.0
RSRS, Koraput	400	23.5	100	27.4
Total/Average	**3200**	**49.5**	**800**	**47.2**

Table.7. Performance bi x bi hybrids in North Eastern states during Spring 2015

Unit	*Target*	*Hybrids*			
		B.Con.1 x B.Con.4		*B.Con.1 x B.Con.4*	
		Quantity	*Yield/100 dfls (kg)*	*Quantity*	*Yield/100 dfls (kg)*
RSRS Jorhat	1000	800	46.5	200	42.0
REC, Agartala	500	400	52.4	100	50.6

REC, Aizawl	500	400	49.7	100	47.5
REC, Imphal	500	400	50.1	100	46.8
REC, Shillong	500	400	48.9	100	40.8
REC, Rangpo	500	400	42.6	100	37.5
Total/Avg.	**3500**	**2800**	**48.4**	**700**	**44.2**

Baishaki 20015

During Baishaki 2015 36800 dfls of M6DPC x (SK6 x SK7) was tested with the farmers of West Bengal and Jharkhand and recorded an average yield of 49.8 kg/100 dfls as against 46.3 kg/100 dfls recorded for 15200 dfls of Nistari x (SK6 x SK7) (Table 8).

Table 8. Performance of multi x bi hybrids during Baishaki 2015

Centre	Hybrids			
	M6DPC x (SK6 x SK7)		Nistari x (SK6 x SK7)	
	Quantity	Yield/100 dfls	Quantity	Yield/100 dfls
REC,Kamnagar	5000	51.6	3000	50.0
REC,Mothabari	5000	47.7	3000	44.3
REC, Rajmahal	1250	44.5	750	43.8
REC, M.P. Raj	350	52.8	150	49.9
DoT(Seri) Malda	6000	50.0	2000	43.0
DoT(Seri),Birbhum	6000	48.5	2000	44.2
DoT(Seri) , MSD	6000	54.0	2000	50.0
DoT(Seri),Nadia	1200	51.0	300	45.0
ZSSO, Malda	6000	48.5	2000	46.7
Total/Average	**36800**	**49.8**	**15200**	**46.3**

Reeling performance of silkworm hybrids tested under Authorization Trail project (AIB:3531)

Cocoon samples of all the hybrids under trail were purchased from farmers after completion of each crop and was subjected for reeling analysis by SCTH Malda and also by the private reeler through out sourcing. The data was analyzed by SCTH Malda. The average performance of all the crops is given as under In Table 9.

Table 9. Reeling performance of test hybrids

Sl. No	Hybrids	Filament Length (m)	Filament Size (d)	Reelability %	Raw Silk %	Neatness (point)	Boil-off loss(%)
Multivoltine x Bivoltine hybrids							
1	M6DPC x (SK6 x SK7)	601	2.75	75.1	31.1	88.5	25.4
2	N X (SK6 x SK7)	574	2.81	74.8	28.3	84.5	26.4
Bivoltine x Bivoltine hybrids							
3	B.Con.1 x B.Con.4	694	2.68	77.4	32.6	88.8	24.7
4	SK6 x SK7	655	2.71	75.0	29.2	86.8	24.5

Grainage performance of test hybrids

The grainage performance the test hybrids at various SSPCs o f NSSO is as given under the Table 10.

Table.10. Grainage performance of test hybrids

SSPC	Actual cocoons procured			Pairs obtained	Dfls obtained	Pairs %	Dfls %	Egg yield	
	By Number	By weight	Cocoon per kg (No.)					Total (g)	Per kg cocoon (g)
M6DPC x (SK6 x SK7)									
Ramnagara	352795	405.53	870	128850	96200	36.52	27.3	30482	75.17
Nistari x (SK6 x SK7)									
Hindupur	586233	627.80	934	225650	208450	38.49	35.6	45213	72.02
B.Con.1 x B.Con.4									
Malavalli	33456	48.0	697	8040	6500	24.03	19.4	2040	42.50
SK6 x SK7									
K.R.Nagar	1035959	1752.50	591	469500	436501	45.32	42.1	116152	66.28

ix. Discussion

Eastern India, especially the state of West Bengal experiences extreme variation in temperature, relative humidity and rainfall. According to climatic conditions, the commercial seasons are broadly divided into two, favourable and unfavourable. The former falls between October to March, when the climatic conditions are congenial for silkworm rearing. Autumn (Nov) and

Spring (Feb) crops come during this period. April (Baisakhi), commercial crop is also considered as partially congenial for silkworm rearing in terms of prevalence of low humidity. On the other hand, the unfavourable period with prevailing high temperature and humidity conditions starting from May to September are not conducible for silkworm rearing of June-July (Shravani) and Aug-Sep (Badhuri & Aswina) crops. Because of high temperature and humidity as well as rainfall, most of the rearers are compelled rear indigenous breed, Nistari , which is very low productive with poor quality. But suitable multi x bi hybrid can successfully be reared during autumn and spring seasons of the plains, which could increase the silk production. The present study has corroborated the idea that new hybrids other than Nistari based hybrids can successfully be reared in West Bengal and similarly new bivoltine hybrids in North –Eastern states can also be reared successfully.

x. Inference / Recommendations

Based on the overall performance at farmers field, during favourable seasons (Agrahayani, Falguni and Baishaki) it is recommended to rear the multivoltine hybrids, M6DPC x (Sk6 x SK7) in West Bengal and Jharkand states. With regard to bivoltine hybrids, it was recommended to rear B.Con.1 x B.Con.4 in West Bengal, Jharkand North Eastern states

xi. Applications made for patenting / commercialization if any

No

xii. References : Nil

xiii .Papers Published : Nil

xiv. Summary

In India, earlier the race authorization programme was conducted with very limited quantity of the test hybrids in different state and central government farms. O f late, it was felt that testing of limited quantity of the test hybrids will not reflect the real performance of the hybrids. Therefore, it was decided to test large quantity (2 lakh dfls od the test hybrids) at the farmers leve and based on the performance hybrids will be authorized in respective zones.

Hence, this programme has been formulated to give a new shape and impetus to the sericulture industry for the Eastern & North Eastern Zone. It will give a major relief to the sericulture industry of the states. Hence, this programme.

xv. Budget Utilized; etc.,

Sl.No.	Item	Amount
1	Cost of dfls (including airlifting charges)	6,47,378= 00
2	Cost of cocoon samples	1,40,033= 00
3	Cost of Labex/Vijetha	3,25,322=00
4	Cost of Bleaching Powder	1,40,092=00
5	Training for farmers	7,64,588=00
6	Printing	2,41,706=00
7	Field day	1,77,088=00
8	Krishimela	2,25,265=00
9	Cost for reeling (Outsourcing)	36,432=00
10	Travel	99,102=00
11	Contingency	29,285=00
Total		**28,26,291=00**

xvi) CERTIFICATE

Certified that the study has been carried out and financial expenditure incurred for executing the study are in accordance with the declaration/certification unknotted at the time of submission of the proposal and sanction obtained from time to time thereafter as per the revisions made.

Signature of the Principal Investigator and Co-investigator(s)

Signature of the Co-ordinator