PROCEEDINGS OF THE MEETING ON PROSPECTS OF SERICULTURE IN TEA AND COFFEE PLANTATIONS

9-10 OCTOBER, 1987


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Central Sericultural Research & Training Institute,
Manandavadi Road, Mysore-570 008

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INTRODUCTION

Use of mulberry plant as an intercrop or shade tree in tea and coffee plantations, including its intensive cultivation in the marginal lands in and around them have recently been drawing attention of many planters, particularly of South India. Not only that, a number of them have already taken up sericulture in parts of their plantation with excellent results. Tea and Coffee plantations being situated mostly in higher rainfall areas support a good growth of mulberry. Simultaneously the higher altitude at which they are grown provides an ideal climate for silkworm rearing, particularly of the internationally acclaimed bivoltine breeds. Silk has not only a current strong domestic and international demand, this situation is expected to continue in future also

To bring this potential to the notice of the planters at large and get a feed back from those who have already taken it up, a meeting was held on the prospects of sericulture in the tea and coffee plantations at Central Sericultural Research and Training Institute, Mysore on 9th and 10th October, 1987 in which about one hundred planters, besides the representatives of various nodal agencies and organisations like UPASI (United Planters' Association of South India), NAWA (Nilgiri Adivasis Welfare Association), Research and Extension Officers of the Coffee Board, Directors and other Sericultural Officers of the State Governments of Karnataka, Tamil Nadu and Kerala and the Member-Secretary and other officers of the Central Silk Board

participated. Deliberations of the meeting are presented in this "Proceedings" which may be of help to those already engaged in sericulture as well as to those proposing to take up the same.

PARTICIPANTS:

A list of participants is given in ANNEX—I.

PAPERS PRESENTED:

A list of papers circulated during the meeting is given below:

1 **ULLAL, S.R. & NARASIMHANNA, M.N.** (1987). Handbook of practical sericulture, 3rd edition, Central Silk Board, Bangalore 560 001, India.

2 **KRISHNASWAMI, S.** (1986). Mulberry Cultivation in South India, Central Silk Board, Bangalore 560 001, India.

3 **KRISHNASWAMI, S.** (1986). New technology of silkworm rearing. Centre Silk Board, Bangalore 560 001, India.

4 **KRISHNASWAMI, S.** (1986). Improved method of rearing young age (Chawki) silkworms, Central Silk Board, Bangalore

5. **NARASIMHANNA, M.N., KANYADI, N.M., RAVIKUMAR, C.** and **BASAVARAJU, H.K.** (1987), Sericulture practices for the hilly areas of South India, Central Silk Board, Bangalore-560 001, India.

6 **NARASIMHANNA, M.N. (1987).** Yes, Bivoltine is possible. National Silkworm Seed Project, Bangalore 560 002, India.

7 **JOLLY, M.S. (1987).** Prospects of Sericulture in tea and coffee plantations, Central Sericultural Research and Training Institute, Mysore 570 008, India.

8 **INDIAN SILK (OCTOBER, 1987).** Central Silk Board, Bangalore 560 001, India.

9 **SATYANARAYANA RAJU & CHANDRASEKHARAIAH (1987).** Introduction of bivoltine silkworm races in the Nilgiri Hills, Indian Silk XXV (12), pp.12-15.

10 **JOLLY, M.S. (1987).** Scope for development of mulberry trees in tea/coffee plantations. Indian Silk XXV (12) pp.16-20.

11 **RAVIKUMAR, C. (1987).** Western ghats as bivoltine region, prospects, strategies and challenges for its development (unpublished).

While the books & journals mentioned at serial 1 to 10 are not reproduced and can be procured on request from the respective author/publisher, text of the unpublished paper mentioned at serial 11 is given in ANNEX-II.

PROGRAMME FOLLOWED:

A copy of the programme followed is given in ANNEX-III.

As maybe seen from the same, the programme of the first day included speeches, discussions, visit to the field and laboratories of the Central Sericultural Research and Training Institute and some film shows on sericulture.

Since marketing of products form an important component of any industry and this question was raised as well during the first day's discussion, on the second day a visit was kept to the Ramanagaram Cocoon Market where large quantities of cocoons are sold every day through auction.

In addition, to show a pattern of intensive farming in sericulture, a visit to the **Ashirvanam monastry** farm of **Father Britto** was also arranged.

The group dispersed on the second day afternoon after lunch.

DETAILS OF DELIBERATIONS:

Welcoming the participants, **Dr. K. Sengupta,** Director Central Sericultural Research and Training Institute, Mysore, outlined the purpose and programme of the meeting.

Following this **Shri. V. Balasubramaniam, I.A.S.,** Member-Secretary, Central Silk Board in his introductory remarks gave an account of the past history, present position and future prospects of the silk industry, particularly highlighting the role India could play in this field. Currently, no doubt he said, China is the biggest producer of silk, producing about 36,000 metric tons, against about 8,800 of India, but she has her limitations in expanding it further. The area of cultivable land in China is around 250 million hectares forming about 12% of the total geographical area whereas in India the cultivable area is around 360 million hectares. In China already about 5 lakh hectares are under mulberry and it might not be possible for her to expand it further, while India has currently only about 3 lakh hectares under mulberry plantation, with a large scope for expansion.

Reviewing the situation in other countries he stated, that Japan who was once the largest producer of silk is drastically reducing her production, whereas the global demand of silk is increasing. All efforts to produce silk synthetically have also failed. This is a situation India can immediately take advantage of.

Referring to the unique capacity of sericulture industry to fit in and co-exist with other cultivations and industries, he explained how China has integrated her sericulture with pisciculture to the advantage of both. In India silk and milk are known to go together, left over of the rearing being used as cattle feed. Similarly, he felt mulberry and tea & coffee plants will also come to grow together to the advantage of both.

Coming to the relevance of sericulture against our socio-economic back drop he stated that silk is consumed mainly by the richer section of people and is produced by the poor. Thus, sericulture helps in transfer of wealth from richer class to the poor. The percentage of distribution of money from silk fabrics stands as follows: Cocoon producer 54.6%, silk reeler 6.6%, twister 8.7%, weaver 12.3% and trader 17.8%. Silk creates employment with least investment and 1 acre of mulberry can engage about 4 to 5 persons for the whole year, engaging men, women and children. It also helps in earning foreign exchange.

Coming to the quality of silk, he stated, that international silk is bivoltine silk, white in colour. In India mainly yellow coloured silk is being produced which is of multivoltine nature. The quality of this multivoltine silk is inferior to that of bivoltine silk which is produced by Japan, China & other countries. In countries like Japan and China due to severe winter, silkworms can be reared only during 7 months in a year. On the contrary, in our country, silkworms can be reared throughout the year and the

mulberry leaf is available in all the seasons. However, the quantity of leaf gained is lost by the quality of silk.

Under the World Bank aided Karnataka Sericulture Development Project it was contemplated to increase the silk production from 2,500 metric tons in 1980 to 4,500 metric tons in a period of five years. Although, this objective has been achieved, another important aim of producing at least 1,000 metric tons of bivoltine silk of international grade has not been achieved. Now, it hardly produces 100-120 metric tons of bivoltine silk.

Sericulture was introduced some time back in the Malnad areas under the Western ghat programme. It is seen that the cocoon yield obtained in these areas are as good as the same obtained in Japan. The average weight of the cocoon is about 2.5 g. The silk obtained from these cocoons is comparable to the silk produced in Japan and China. Thus, a programme is being undertaken to produce bivoltine silk in the hilly areas. Presently, large parts of this area are covered by tea and coffee plantations. To start with, a strategy is being evolved to use mulberry as an intercrop in these plantations upto a height of 15-20 feet. On one hand, these mulberry plants could give shade to the coffee and tea plants and on other the excess leaf produced could be used for silkworm rearing with the available labour. It could give an additional income of about Rs. 15,000 per hectare of land. The mulberry can be grown at a distance of 12'x12' or 15'x15' in them. Apart from intercropping, mulberry plants could also be grown in an intensive manner in the marginal lands in and around these plantations. Mulberry could also be grown as border trees.

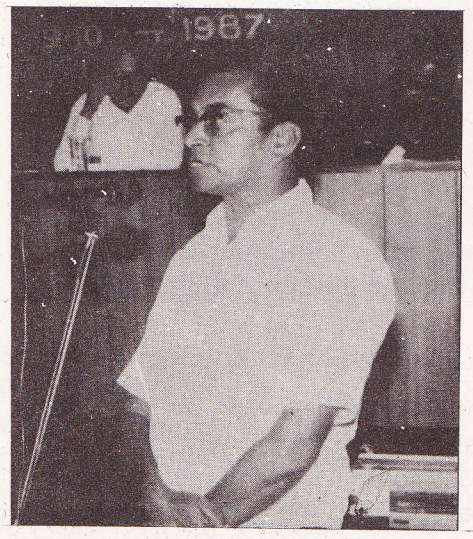
Allaying the fears of the planters that tea or coffee plantations could turn into mulberry plantations he stated that this was not simply possible as due to its labour intensiveness it was not possible to have mulberry cultivation and silkworm rearing in more than 5 to 10 acres by a single or one group of persons.

He finally requested the planters to take up sericulture specially bivoltine rearing so as to produce the international quality silk in the country.

After the Member-Secretary, Central Silk Board, **Shri H.K. Shivananda,** Commissioner for Sericultural Development and Director of Sericulture, Govt. of Karnataka addressed the gathering. He stated that earlier sericulture was confined to only 3-4 districts in Karnataka and now it has spread to almost all the districts. He observed that under the World Bank Programme, the objective of producing 1,000 metric ton of bivoltine silk was not met because of certain drawbacks. He appealed to the planters to take up mulberry either as an intercrop or as monocrop in the vacant lands/border areas of the plantations. He felt that even if 1-2 acres were spared for mulberry cultivation by each planter a revolution could be achieved.

Shri N.M. Kanyadi, Dy. Director (Sericulture), Hassan, while explaining his experiences in Malnad area informed that for successful silkworm rearing, environment and garden contributes to 73% and silkworm race, rearing technology and good hatching contributes 9% each. In hilly areas, good environment and garden can be obtained easily. He explained that there are many instances where farmers have obtained an

average of 72 kg cocoon yield for 100 dfls throughout the year with an income of Rs 40-50,000. Thus bivoltine rearing can be easily taken up by the planters in the hilly areas. He also informed that the department of sericulture is ready to help them at all stages.

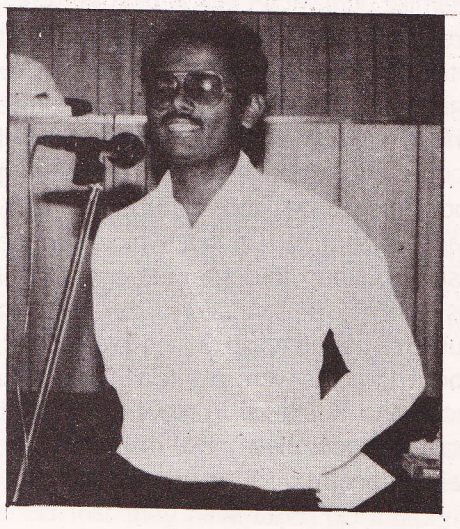


Shri Nagasubramanian, Regional Dy. Director, State Sericulture Department, Govt. of Tamil Nadu, Coonoor, welcomed the concept of raising mulberry as an intercrop. But he stated that enough data of mulberry as a shade tree were not available at present. However, mulberry could be grown at border areas so that maximum leaf could be utilised from these plants. He desired that saplings, at least 10 months old, should be made available to the planters on a large scale.

Shri Balasubramanian, Joint Director (Extn), Coffee Board indicated that India ranks fourth in the World in Coffee production. The production of coffee has increased from 1,35,000 tons in 1970-71 to 1,95,000 in 1984-85. Earlier there was no extension support and now the work has been decentralised. Although, high yielding coffee varieties have been introduced, the hike in wages and cost of fertilizers have made the coffee plantation less profitable. In recent years, pepper has been introduced as an intercrop with coffee. He felt that mulberry could also be a good intercrop in coffee plantations.

Recalling his earlier experience of using mulberry as a shade tree in coffee plantations he stated that he had started this about twenty years back in the coffee plantations of Vizag district with very good results. Some silkworms were also reared, but this could not be followed up due to the difficulty in the marketing of silk cocoons. With the Central Silk Board and the State Governments now taking care of all sectors of sericulture industry, it should be possible to try this now in a more systematic manner and on a larger scale.

Ms. Victoria Armstrong, President, Nilgiri Adivasi Welfare Association (NAWA) briefly explained how sericulture could help the upliftment of the tribals of the Nilgiris. She however, felt that the scientists, extension workers and trainers have to play important roles in this matter.



Shri Michael Vethasiromani, Director, Tribal Welfare, Govt. of Kerala & the Officer on Special Duty (Sericulture) stated that in Idukki district about 200 acres of slopy land has been covered with mulberry. They have come up very well. The farmers are very enthusiastic in taking up sericulture. Their average yield of cocoons for the last one year has been about 55 kg per 100 dfls. He observed that Kerala State is full of plantations like tea, coffee, rubber and cardamom. Besides tea and coffee plantations mulberry could be grown in between the rubber plants at a spacing of 2' x 2' for initial 4-5 years. Similarly, mulberry could be grown as intercrop in cardamom plantations also so as to obtain additional income. Fluctuations in the price of cardamom could be compensated by taking up sericulture.

Shri Swaminathan, from United Planters Association of South India (UPASI) indicated that tea is grown in 25,000 hectares in Nilgiris alone. He briefly explained how mulberry could act as a shade tree in the tea gardens. The shade plants help in bringing down the temperature, break wind currents and minimise ultra-violet rays at high altitudes. Further, these plants increase the soil fertility by bringing nutrients from deeper region and releasing the same on the surface as humus. They give additional income also through timber. Depending upon the slope and altitude, 15-20% shade is required in tea which can be easily obtained through mulberry. UPASI has taken up sericulture by planting mulberry as intercrop in tea plantations. About 15 acres were planted in Banagudi Sholai and Kolithurai in November, 1986 and the plants have now reached more than 10' height.

He observed that mulberry can be planted as intercrop at an altitude of 1,000 MSL and lot of scope exists for sericulture in hilly areas. Apart from intercrop, mulberry could be planted in border areas and uncultivated areas also. He, however, desired that the planters should be educated both in mulberry cultivation and silkworm rearing through adequate extension demonstration. Other supports like subsidy for construction of rearing house and marketing facilities should also be provided. Following this a number of planters who have already taken up sericulture and some representatives from the planting companies were requested to indicate their experience and views.

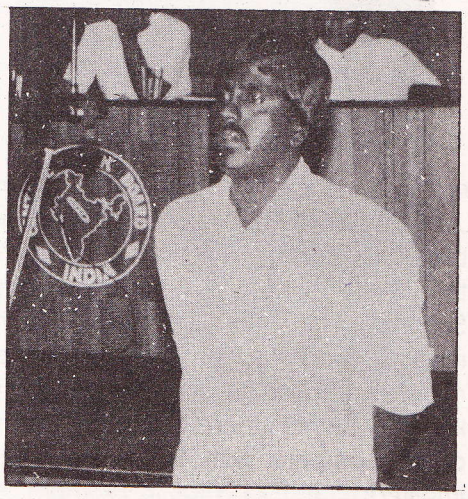
Shri Nanjappagowda of Sakleshpur, Hassan District, observed that in coffee plantations, labourers are adequately available and he has harvested good cocoon crops even during heavy rainfall periods. He indicated that mulberry could be planted around the fence also to get higher leaf yield.

Shri Amruthegowda of Padavalelu, Chikmagalur district, observed that for all these years, he was growing mulberry in unfertilised areas and now mulberry is grown in fertilised areas along with coffee. He obtained 70 kg of cocoons for 100 dfls in the first crop. He desired that specific guidelines should be there for purchase of cocoons for seed. He also indicated that cheque system can be introduced in the markets apart from fixing minimum floor price for cocoons. Of late, he is facing the uzi fly problem and requested the Government to take steps to control this.

Shri K.R. Nagaraj of Alur Taluk, Hassan District, observed that in his 5 acres of coffee plantations, mulberry has been planted recently as intercrop. Sericulture was introduced in his taluk in 1974 and he felt that his taluk is ideally suited for sericulture. He got 32 kg cocoon yield for CB during first rearings and 70 kg yield during 2nd crop for bivoltine. He desired that rearing facilities should be improved and the number of eggs per layings to be increased so as to obtain better yields.

Shri B.L. Ramdas of Neranki, Chikkamagalur district, explained that very recently he has taken up mulberry plantation. From the deliberations he felt that there is a good scope of taking up sericulture in coffee plantations and requested all the planters to consider this.

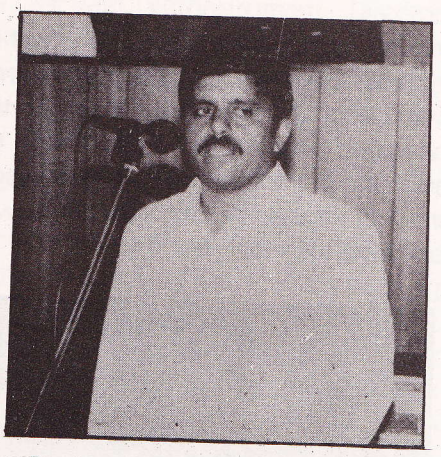
Shri Chandragowda of Mudigere Taluk, Chikmagalur district, wanted to know if mulberry could be grown without irrigation. Recently, he has planted coffee in 10 acres of land and had problems of shade trees. He has been informed about the intercropping in coffee with mulberry and he hoped that this scheme will be successful in future. Since sericulture is not a time bound programme, he desired that incentives should be given to the labourers in the form of the higher wages or overtime as also to the supervisors who look after the rearings.



Shri Imtiaz Ahmed of Balehennur, Chikmagalur District, indicated that growing mulberry in coffee plantations is a novel scheme. He desired that small and marginal farmers should get adequate benefit from the chawki rearing centres. He desired that the marketting system should be improved with the opening of more markets. He also desired that the auction system at Ramanagaram market should be improved.

Three planters from Kotagiri, the Nilgiris, Tamil Nadu viz. **Shri T.K. Bheemagowda, J. Raju & M. Gopal,** also spoke and expressed their willingness to try mulberry as a shade tree in their tea plantations.

Shri P. Haridas, Deputy Manager (Technical) of Tata Tea Limited, Munnar, Kerala State was then invited to speak. He stated that they have taken up mulberry



raising in their tea plantations during July-August, 1987. He wanted to know the effect, plant protection measures for tea plants could have on the silkworms. Secondly, he informed that mulberry requires good irrigation and tea plants do not require much irrigation. He wanted to know whether these mulberry plants could compete with tea if they were irrigated.

Replying to certain points raised by planters and others Shri. Govindaraju, Joint Director (Research), Coffee Research Institute, Chikamagalur informed that recently a discussion was held between the Central Silk Board, KSSDI and Coffee Board Scientists on different aspects of introducing mulberry in coffee/tea plantations. The deliberations revealed that mulberry can be safely grown either as intercrop or as monocrop. This could give additional income to the planters. Moreover, mulberry has no major diseases and pests known to attack the coffee plants. However, trials are being initiated to find out the effect of plant protection measures carried out on coffee plants on silkworm rearing.

Giving additional clarification on the subject,

Dr. Ravi Kumar, Scientist, Karnataka State Sericultural Development Institute indicated that all pesticides or fungicides have recidual toxic effects for a certain period. Mulberry can be fed to the silkworms safely after 10-15 days of spraying. This should not have any adverse effect on silkworm rearing. With regard to the irrigation problems, he informed that mulberry is very resistant to drought. Inspite of severe drought in Karnataka, the mulberry is thriving well. Further, mulberry is a deep rooted plant and absorbs inner soil nutrients and as such there should not be a competition between mulberry and coffee/tea plants.

Dr. M.N. Narasimhanna, Director, National Silkworm Seed Project, was then requested to sum up the discussions. Summing up the discussions, he indicated that sericulture has come up very well in the Malnad area through the efforts of the planters. The major factors have been good environment prevailing and rich humus in the soil in Malnad region. He observed that the mulberry leaf yield per unit area in Malnad is not less than in the

plains. In Malnad area, mulberry can be planted during monsoon seasons. On one side, this establishes mulberry well and on the other rearing can be skipped off during the heavy rainy seaons. The farmers in Malnad area can take up new technologies of silkworm rearing and get yields as high as 70 kgs per 100 dfls. As regards plant protection measures both in coffee and tea plantations, mulberry leaves could be harvested 10-15 days after the spray. This should not be a hinderance to taking up sericulture in hilly areas. He also informed that proper pricing system for cocoons is being developed for the Malnad area.

The pre-lunch session ended with this summing up.

POST LUNCH SESSION

The post-lunch session started with a visit to different labs and field of the Central Sericultural Research and Training Institute, Mysore, followed by the screening of two films on sericulture. They were followed by further discussions. The afternoon session of discussions was chaired by **Shri P.G.V. Nair,** Ex-Director of Sericulture, Government of Karnataka and Technical expert of the Agricultural Finance Corporation (AFC), Government of India. Initiating the discussions, **Dr. R.K. Datta,** Director (Technical) Central Silk Board, briefly explained how mulberry could be introduced in tea and coffee plantations. This could help the country in producing quality Bivoltine silk. China which was supplying bivoltine silk to India, is now reluctant to supply the same due to some changes in their policy. This has resulted in an increase in the price of silk in the country. He felt that introduction of sericulture in tea and coffee plantations, could help in the production of better quality silk. He added that the rearing of silkworm needs the adoption of an appropriate technology. He further stressed that there is also a need to increase the trained manpower.

Dr. Manjeet S. Jolly, Ex-Director, Central Sericultural Research and Training Institute, Mysore, giving the background of organising this meeting, informed that the idea was mooted by Shri V. Balasubramaniam, Member-Secretary, Central Silk Board, to increase the production of Bivoltine silk. Although the original idea was to hold a seminar at a national level, it has currently been restricted to planters of Karnataka, Tamilnadu and Kerala only. He informed that the planters from Hassan district had visited this Institute recently and they have accepted the technology. As regards the control measures for the pests and diseases he clarified that the residual toxicity may be for 10 to 15 days and the mulberry leaves could be safely fed to the silkworms after that period. He hoped this meeting will be a stepping stone for bivoltine development in the country.

Shri Venugopalan Nair cautioning the planters informed that the sericulture is not an easy task. Lots of hurdles will have to be faced. In hilly areas, heavy rainfall and high humidity might at times create problems. Initially rearing results are always good which tends to come down over the years. He thus requested the planters to be constantly in touch with the sericulture department and the Central Silk Board units for guidance. He also appealed to the researchers to perfect and give complete details of mulberry cultivation and silkworm rearing in the hilly areas to the planters. He stated that disinfection is not often carried out by the farmers properly. This often results in building up of micro-organisms in the rearing houses, causing outbreak of diseases. He requested the planters to be very careful in this matter..

Shri Michael Vethasironmani desired that the social forestry department should take up mulberry cultivation on a large scale. He wanted to know the possible assistance/support that could be received from the Central Silk Board.

Shri T.V. Alexander, Manager, Valparai, Coimbatore Dist., Tamil Nadu Estate of M/s. Tata Tea Limited, desired that Central Silk Board should establish demonstration plots in different areas so that the planters could be convinced of the results. He further informed that there are two varieties in coffee viz. robusta and arabica, grown under different conditions. He wanted more details of intercropping with mulberry

Replying to the points **Dr. A.G. Sambamurthy Reddy,** Dy. Director (Extension), Regional Coffee Research Station, Wynad informed that robusta is a surface feeder and in the initial 3 to 4 years, mulberry cultivation could be taken up. Arabica has deep root system and how it competes with the mulberry has to be worked out. Experiments have been initiated and it might be possible to give clarifications in a short time. At present, robusta plantation appears to be more suitable for taking up inter-culture with mulberry.

A few more researchers from the Coffee Research Institute also spoke.

Discussion of the afternoon session also ended with a summing up by **Dr. M.N. Narasimhanna** Director, National Silkworm Seed Project who expected good bivoltine crops to be raised in the hilly areas of Karnataka, Tamil Nadu and Kerala provided proper technologies were followed.

The meeting ended for the day with thanks to the Chair.

Field Visits

On 10.10.87 the participants left Mysore at about 8.30 AM and reached the Ramanagaram Cocoon Market, one of the biggest cocoon markets of the Karnataka State at about 10.30 AM. **Shri Chikkavenkatappa,** Asst. Director (Cocoon Market) conducted the visit and explained how the bidding weighment and payment are made to the satisfaction of both the sellers and the purchasers, eliminating the middle men. The participants for themselves saw the whole process. He explained that on an average of about 30,000 to 40,000 kgms of cocoons are transacted everday in the market and most of the rearers get their full payment within a period of 3-4 hours. Later, during a group discussion **Shri Chikkavenkatappa** explained that mostly reelers deposit and bring enough money to purchase the cocoons they require and only in exceptional cases they have to go out to bring more money. **Shri B.L. Ramdas** suggested that this could perhaps be avoided if banks were involved with bank guarantee from the purchasers. As compared to arrivals, space in the cocoon market appeared to be less. On that it was explained that though there were three halls, most of rush was in the first hall and in one mostly bivoltine cocoons were transacted.

Then the particpants visited the sericulture farm of the Asheervanam Benedictine Monastry **Father Britto** Chief of the Monastry addressed the visitors and told of his experience with sericulture. The Monastry, he said, has about 10 acres of land under mulberry on which during each crop about 2100 dfls are brushed. In addition, it sells away the cuttings. The average yield of cocoons is about 40 to 50 kg per 100 dfls for bivoltines and about 30-35 kg for multivoltines. Depending upon the season, he rearers both the varieties. Besides income, the employment potential of his farm has gone up very much since the introduction of sericulture. Finally, he advised the participants to take up sericulture which could be a good industry for the rural area.

At Bangalore, after lunch, a small concluding session was held. During that the participants thanked the organisers profusely & indicated that they had been greatly benefitted by this meeting & field visits. Further they requested for such meetings to be arranged in future also so that they could exchange views and discuss their problems. They wanted the next meeting to be held in some coffee/tea growing areas.

Annex-I

LIST OF PARTICIPANTS

CENTRAL SILK BOARD

01 Shri V. Balasubramanian, I.A.S., Member-Secretary, Central Silk Board, Bangalore.

02 Dr. Manjeet S. Jolly, Ex-Director, C.S.R.T.I., Mysore

03 Dr. K. Sengupta, Director, C.S.R.T.I., Mysore

04 Dr. M.N. Narasimhanna, Director, N.S.S.P., Bangalore

05 Dr. R.K. Datta, Director (Tech.), C.S.B., Bangalore

06 Shri N. Suryanarayana, Joint Director, C.S.R.T.I., Mysore

07 Shri M.K.R. Noamani, Joint Director, C.S.R.T.I., Mysore

08 Dr. S. Venugopala Pillai, Joint Director, C.S.R.T.I., Mysore

09 Shri H.M. Basavanna, Dy. Director, C.S.R.T.I., Mysore

10 Shri N.K. Ganesh, Dy. Director, C.S.R.T.I., Mysore

11 Shri V. Thyagarajan, Dy. Director, C.S.R.T.I., Mysore

12 Dr. S.N. Chatterjee, Dy. Director, C.S.R.T.I., Mysore

13 Dr. S.B. Dandin, Dy. Director, C.S.R.T.I., Mysore

14 Shri K.V. Benchamin, Dy. Director, C.S.R.T.I., Mysore

15 Shri P.C. Choudhury, Dy. Director, C.S.R.T.I., Mysore

16 Shri M.S. Kodandaram, Dy. Director, C.S.R.T.I., Mysore

17 Shri C.S. Nagaraj, Dy. Director, C.S.R.T.I., Mysore

18 Shri C.V. Venkataramu, Dy. Director, C.S.R.T.I., Mysore

19 Shri S.S. Ghosh, Dy. Director, C.S.R.T.I., Mysore

20 Shri B.D. Singh, Dy. Director, C.S.R.T.I., Mysore

21 Smt. R.G. Geetha Devi, Dy. Director, C.S.R.T.I., Mysore

22 Shri Puttaswamy Gowda, S.R.O., R.S.R.S., Coonoor

23 Shri J.Sampath, Dy. Director (Pub.), C.S.B., Bangalore.

24 Shri G.S. Shivaprakash, Editor, Indian Silk, Central Silk Board, Bangalore.

25 Shri M.N. Ramesh, Editorial Staff, Indian Silk, C.S.B., Bangalore.

26 Shri H. K. Basavaraja, S.R.O., N.S.S.P., Bangalore.

DEPARTMENT OF SERICULTURE, GOVERNMENT OF KARNATAKA

27 Shri H.K. Shivananda, I.A.S., Commissioner, for Sericultural Development and Director of Sericulture, Govt., of Karnataka, Bangalore

28 Shri D. Mahadevappa, Joint Director of Sericulture, Karnataka State Sericulture Development Institute, Thalaghattapura, Bangalore.

29 Dr. C. Ravikumar, Scientific Officer, K.S.S.D.I., Bangalore

30 Shri N.M. Kanyadi, Dy. Director of Sericulture, Hassan

31 Shri M. Nanjappa, Asst. Director of Sericulture, Chickmagalur

32 Shri K. V. Srinivasa, S.E.O., Hassan

33 Shri Mallikarjunappa, S.E.O., Mutigere

34 Shri S.S. Mallasetty, S.D., Bikkodu, Hassan District

35 Shri B.R. Sanaiah, S.D., Sakleshpur

36 Shri. C. Doreieswamy, S.D. Sekleshpur

37 Shri. L. Shakeel Ahmed, S.S.I., Koppa

38 Shri. Gopalakrishna, S.I. Belur

39 Shri. K.C. Shivegowda, S.I. Alur, Hassan Dt.

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53 Shri. S. Ramu, Trg., Asst. (Agri. Extn.) U.P.A.S.I., Coonoor

54 Ms. Victoria Armstrong, Hon. Treasurer, Nilgiri Adiwasi Welfare Association, Kotagiri, The Nilgiris.

55 Shri. K. Vijaya Kumar, Sr.C.D.O., N.A.W.A., Kotagiri, The Nilgiris.

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56 Shri Nanjappa Gowda, Sakleshpur, Hassan Dt., Karnataka

57 Shri Amruthegowda, Padavaladu, Chickmagalur, Dt., Karnataka

58 Shri K.R. Nagaraj, Alur Tq., Hassan Dt., Karnataka

59 Shri B.L. Ramdas, Neeranki, Chickmagalur Dt., Karnataka

60 Shri M.R. Chandregowda, Mudigere, Chickmagalur Dt., Karnataka

61 Shri C.R. Imtiaz Ahmed, Balehonnur, Chickmagalur Dt., Karnataka

62 Shri T.K. Bheemagowda, Kotagiri, Nilgiris, Tamilnadu

63 Shri J. Raju, Kotagiri, The Nilgiris, Tamilnadu

64 Shri M. Gopal, Kotagiri, The Nilgiris, Tamilnadu

65 Shri P. Haridas, Dy. Manager (Technical) Tata Tea Ltd., Munnar Kerala

66 Shri T.V. Alexander, Manager, Tata Tea Ltd., Valpari, Coimbatore, Tamilnadu.

67 Shri Mainkutty, Balehonnur, Chickmagalur Dt. Karnataka

68 Shri C.R. Prabhashankar, Balehonnur, Chickmagalur Dt., Karnataka

69 Shri M.T. Ramikumar, Joidal, Chickmagalur Dt., Karnataka

70 Shri K.U. Lokappa Gowda, Kabbinahally, Chickmagalur Dt. Karnataka

71 Shri U.C. Poorneshgowda, Ullavagilu, Chickmagalur Dt. Karnataka

72 Shri K.D. Kallegowda, Kabbinahally, Chickmagalur Dt, Karnataka

73 Shri U.D. Kenche Gowda, Ullevagilu, Chickmagalur Dt, Karnataka

74 Shri K.N. Mukundh Gowda, Kabbinahaly, Chickmagalur Dt., Karnataka

75 Shri K.E. Narayana, Kabbinahally, Chickmagalur Dt., Karnataka

76 Shri Somegowda, Mudigere, Chickmagalur, Dt., Karnataka

77 Shri Premaraju, Mallahally, Chickmagalur Dt., Karnataka

78 Shri Shantharaju, Mallahally, Chickmagalur Dt., Karnataka

79 Shri H.R. Lohitaksha, Alur Tq., Chickmagalur Dt., Karnataka

80 Shri B.R.Thimmappa, Bettahally, Chickmagalur Dt., Karnataka

81 Shri M.N. Shivananjappa, Nallur, Chickmagalur Dt., Karnataka

82 Shri A.P. Mahendra, Abbara, Chickmagalur Dt., Karnataka

83 Shri B.B. Nanjundegowda, Bellur, Chickmagalur, Dt., Karnataka

84 Shri H.M. Earappa, Malagabele, Chickmagalur Dt., Karnataka

85 Shri M.S. Somashekar, Malagabele, Chickmagalur Dt., Karnataka

86 Shri Muddashetty, Nallur, Chickmagalur Dt., Karnataka

87 Shri Suresh, Biligarahally, Chickmagalur Dt., Karnataka

88 Shri Kushalappa, Biligarahally, Chickmagalur Dt., Karnataka

89 Shri G. Desousa, Channapur, Chickmagalur Dt., Karnataka

90 Shri Francis, Thimmalapura, Chickmagalur Dt., Karnataka

91 Shri B.M. Somasekhar, Bikkedu, Hassan Dt., Karnataka

92 Shri C.K. Karumbaiah, Bikkodu, Hassan Dt., Karnataka

93 Shri K.C. Mahesh, Archally, Hassan Dt., Karnataka

94 Shri M.P. Niranjankumar, Belur Tq., Hassan Dt., Karnataka

95 Shri Nanjegowda, Tholalu, Hassan Dt., Karnataka

96 Shri Rangaswamy, Tholalu, Hassan Dt., Karnataka

97 Shri D.B. Tayaraju, Magasoor, Hassan Dt., Karnataka

98 Shri C.P. Harish Kumar, Arehally, Hassan Dt., Karnataka

99 Shri Hafeez Ahmed, Arehally, Hassan Dt., Karnataka

100 Shri Ikbal Ahmed, Shanivarasantha, Mercara Dt., Karnataka

101 Shri Rizwan Khalid, Arehally, Hassan Dt., Karnataka

102 Shri A.A. Khan, Cochin, Kerala

103 Shri T.N. Balasubramanian, Kiikotagiri, The Nilgiris, Tamilnadu

104 Shri J. Gopal, Kotagiri, The Nilgiris, Tamilnadu

105 Shri M. Armugam, Kotagiri, The Nilgiris, Tamilnadu

106 Shri N. Dharman, Kotagiri, The Nilgiris, Tamilnadu

107 Shri M. Pandurangam, Kotagiri, The Nilgiris, Tamilnadu

108 Shri A. Kuppuswamy, Kotagiri, The Nilgiris, Tamilnadu

109 Shri J. Pandian, Kotagiri, The Nilgiris, Tamilnadu

110 Shri M. Arjunan, Kotagiri, The Nilgiris, Tamilnadu

111 Shri V. Shivan, Kotagiri, The Nilgiris, Tamilnadu

112 Shri L. Bellan, Kotagiri, The Nilgiris, Tamilnadu

113 Shri K.J. Shivaraman, Kotagiri, The Nilgiris, Tamilnadu

114 Shri Baligam, Kotagiri, The Nilgiris, Tamilnadu

115 Shri Vikram Kapur, Kullakandy, The Nilgiris, Tamilnadu

116 Shri D. Hegde, Chamaraj, P.O., The Nilgiris, Tamilnadu

117 Shri Raghunatha, Balehonnur, Chickmagalur Dt., Karnataka

118 Shri Mohana, Mugunti, Chickmagalur Dt., Karnataka

119 Shri Maheshchandra, Balehonnu, Chickmagalur Dt., Karnataka

120 Shri H.J. Rathnakara Hedade, Koppa, Chickmagalur Dt., Karnataka

121 Shri Raghusetty, Koppa, Chickmagalur Dt., Karnataka

122 Shri Manjunatha, Nallur, Chickmagalur Dt., Karnataka

123 Shri N.N. Honnappa, Nallur, Chickmagalur Dt., Karnataka

124 Shri N.B. Rangasetty, Kodagathavalli, Chickmagalur Dt., Karnataka

125 Shri Moganna Gowda, Kalu Koppal, Chickmagalur Dt., Karnataka

126 Shri H.N. Dharmalingam, Alur, Hassan Dt., Karnataka

127 Shri M.R. Shaffi Ahmed, Alur Tq., Hassan Dt., Karnataka

128 Shri Siddalingaiah, Alur Tq., Hassan Dt., Karnataka

129 Shri K.J. Parameshwara, Koppa, Hassan Dt., Karnataka

130 Shri Rangacharya, Belur, Hassan Dt., Karnataka

131 Shri N.C. Ananda, Sakleshpur, Hassan Dt., Karnataka

132 Shri M.A. Raju, Sakleshpur, Hassan Dt., Karnataka

133 Shri B.K. Belliappa, Sakleshpur, Hassan Dt., Karnataka

134 Shri D.V. Manjappa, Sakleshpur, Hassan Dt., Karnataka

135 Shri A.S. Channabasappa, Sakleshpur, Hassan Dt., Karnataka

136 Shri M.V. Basavaraj, Sakleshpur, Hassan Dt., Karnataka

137 Shri S.V. Subba Rao, Sakleshpur, Hassan Dt., Karnataka

138 Shri J.S. Shivakumar, Sakleshpur, Hassan Dt., Karnataka

139 Shri Ananda, Bharatur, Hassan Dt., Karnataka

140 Shri R.V. Rangasetty, Alur, Hassan Dt., Karnataka

141 Shri K.C. Shivegowda, Alur, Hassan Dt., Karnataka

142 Shri Nagalingaswamy, Alur, Hassan Dt., Karnataka

143 Shri Lakshminarayana, Mysore, Mysore Dt., Karnataka

Annex-II

WESTERN GHATS AS BIVOLTINE REGION — PROSPECTS, STRATEGIES AND CHALLENGES FOR ITS DEVELOPMENT

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KARNATAKA STATE SERICULTURE DEVELOPMENT
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I. INTRODUCTION:

Indian Sericulture industry has been passing through its most dynamic phase of development during this decade and has crossed many of its traditional and agroclimatic barriers successfully. With the result, today we find sericulture industry flourishing in almost all the regions, where sericulture was never thought to be possible. In this development, it has always been the enterprising farmer who has shown the lead in his quest for newer direction, adventure and newer means of development and additional income generation. The newer technological innovations have been immensely helping the farmers in the stabilisation of the sericulture productivity.

We have more than doubled our silk production during the last decade and have come to occupy the second place in the world silk production today. However, our attempts to develop bivoltine sericulture to produce the raw silk of international grade for export have not met with equal success. Looking to the long term requirements and perspectives, it is imperative, to develop bivoltine sericulture in India. The experience of the past decade shows that bivoltine requires better agroclimate, nutritious leaf, infrastructure and management. In this article, it is being advocated to select favourable bivoltine regions exclusively, and also favourable bivoltine seasons in maidan regions, for developing bivoltine sericulture. Further, an attempt is being made to examine the suitability of western ghats region as bivoltine region and to discuss the prospects, the strategies to be adopted, and the challenges to be overcome, for the development of bivoltine sericulture in this region.

II. WESTERN GHATS REGION:

A. Geography and resources:

The Western ghats constitute the second important hill ranges of our country, next only to the Himalayas. These hill ranges run to a length of about 1,600 kms almost parallel to the west coast starting from the mouth of 'Tapthi' river in Dhule district of Maharashtra, extending through the states of Goa, Karnataka, Kerala and ending at Kanyakumari in Tamil Nadu. (Fig. 1 & Table -1)

The Western ghat region generally receives heavy rainfall ranging from 2000 mm to 7000 mm. The bulk of the rainfall is during the South West monsoon and is very heavy in the southern parts (western slopes). The northern part specially, the eastern slopes receive relatively low rainfall restricted to 4 months of the South West Monsoon. The Western ghat is endowed with abundant water resources. Most of the rivers in peninsular India have their origin in the Western ghats. The dependable surface water potential has been estimated at 1.19 lakhs mm^3. The tapable ground water potential is placed at 10050 mm^3 in the region. These rivers and their tributaries form the main sources of irrigation in this region and there exists no shortage of water resources throughout the year. The western slopes of the ghats have natural cover of ever green forest which changes to moist and then to dry deciduous type as one comes to eastern slopes.

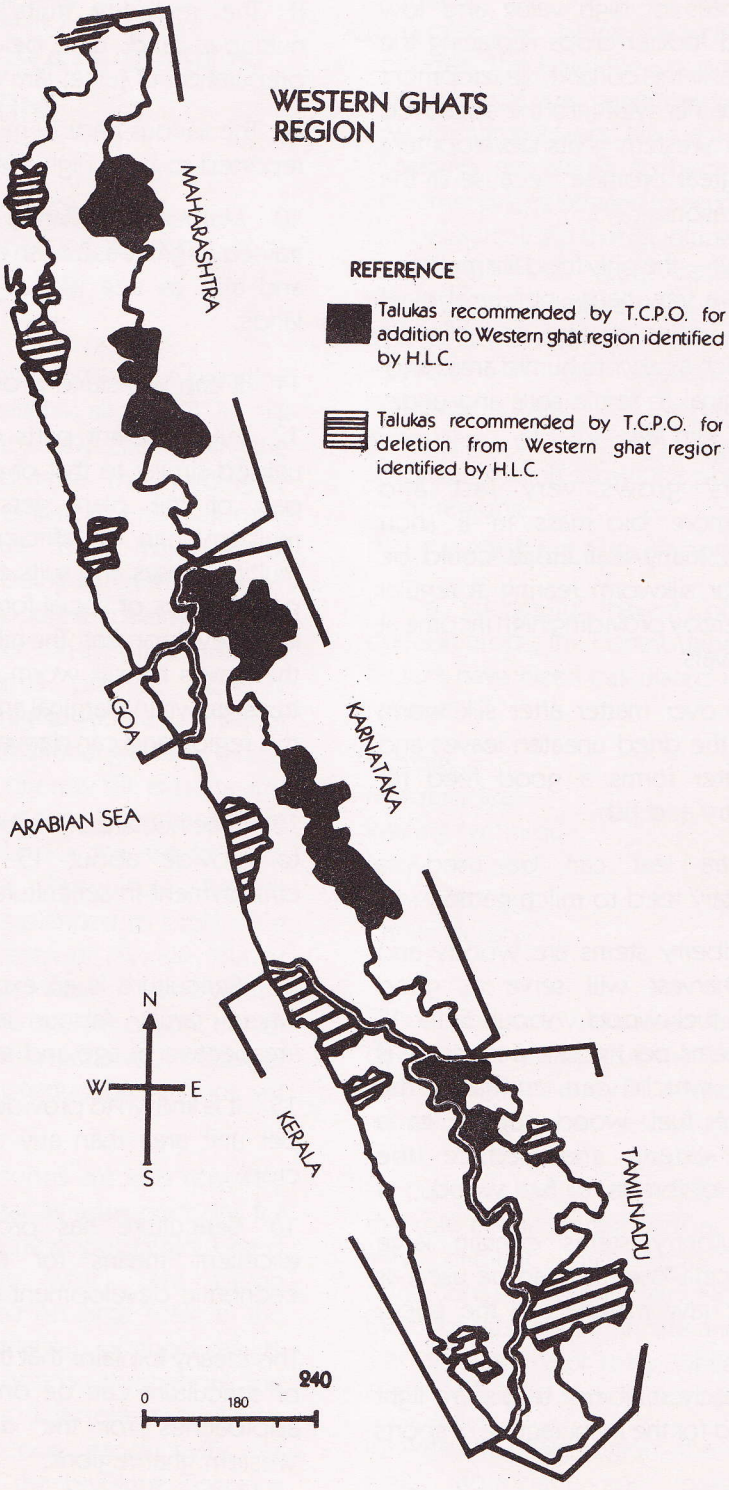
B. Agroclimate:

The Western ghats region is blessed with a cool humid climate in south eastern slopes and warm humid climate in the north western slopes. The co-efficient of variation of rainfall varies from 15% to 25% and the number of rainy days ranges from 130 to 80 days from west to east. Of the total amount of annual rainfall, March to May receives about 5%, June-September about 80%, and October to December about 10%.

The soils belong to red and lateritic groups and differ in texture from sandy loam to clayey loam, with colour varying from light grey to deep grey. The soils are acidic to neutral in reaction, rich in organic matter, have good aggregating ability and good drainage. The total soluble salts are well below the sensitivity limits and are well supplied with potassium, but are generally low in available phosphorus, poor in calcium and magnesium, and respond well to liming, manuring and other management practices.

III. SUITABILITY OF SERICULTURE TO THE APPROVED DEVELOPMENTAL POLICIES OF WESTERN GHATS REGION:

The Western ghat region rich in natural resources, are at a serious disadvantage in deriving benefits from modern industry and intensification of agriculture. In the policies approved for the 7th plan, emphasis has been put on strategies for rebuilding the resources base of soil, water, and vegetation cover, and to generate large scale employment for local population through a process of eco-restoration. It is planned to encourage hill slope agriculture under


WESTERN GHATS
REGION
REFERENCE
Talukas recommended by T.C.P.O. for addition to Western ghat region identified by H.L.C.
Talukas recommended by T.C.P.O. for deletion from Western ghat regior identified by H.L.C.
MAHARASHTRA
GOA
KARNATAKA
ARABIAN SEA
KERALA
TAMILNADU
N
W
E
S
0
180
240

perennial trees of high value and low volume, and fodder crops replacing the annual crops. In this context, development of sericulture fits well into the approved strategies of western ghats development and holds great promise because of the following reasons:

1 Mulberry — the only food for mulberry silkworm, is a very hardy perennial plant that grows under diverse eco-climatic situations such as cool to humid areas,arid, waste, marginal to fertile soils and under 20" to 160" rain fall.

2 Mulberry grows very fast and produces more bio-mass in a short period, and many leaf crops could be harvested for silkworm rearing at regular intervals, thereby providing high income at regular intervals.

3 The left over matter after silk worm rearing i.e., the dried uneaten leaves and silkworm litter forms a good feed for cattle, poultry and fish.

4 The extra leaf can be used as supplementary feed to milch cattle.

5 The mulberry stems are woody and after leaf harvest will serve as good sources of fuel wood. About 5 to 10 tonnes of stems per hectare per annum is produced which can mitigate the problem of fuel wood supply to a significant extent and reduce the denudation of forests for fuel wood.

6 The mulberry stems contain large amount of cellulose and can be used as one of the raw materials in the paper industry.

7 The woody mulberry trunks are light and are used for the manufacture of sports goods.

8 The mulberry fruits are juicy and nutritious and can be used for the preparation of juice, jam and jelly.

9 The various parts of mulberry plant are reported to have high medicinal value.

10 Mulberry by nature is a tree. It is trained to grow as a bush under cultivation and also as tree in marginal and waste lands.

11 It can withstand drought well.

12 All the plant parts of mulberry are utilised similar to that of coconut and no part of the plant gets wasted. Thus mulberry can be efficiently utilised for multipurposes and suits excellently in the programmes of social forestry, and waste land development. The hilly tribals can use the leaves for silk worm rearing from the trees grown in marginal and waste lands of this region and can derive regular income.

13 One hectare of mulberry is estimated to provide about 15 work years of employment in sericultural activities.

14 Sericulture is an excellent example, where family labour is fully utilised, irrespective of age and sex.

15 It is known to provide highest income per unit area than any other agriculture crop.

16 Sericulture has proved to be an excellent means for the social and economic development of rural areas.

This clearly explains that the development of sericulture can be one of the sound approaches for the development of Western ghat regions.

IV SUITABILITY OF WESTERN GHATS REGION FOR BIVOLTINE SERICULTURE

A. NEED FOR BIVOLTINE SERICULTURE IN INDIA AND ITS PRESENT SITUATION:

Japan, the leading producer of bivoltine silk, has been steadily sliding in its silk production for the past decade, giving the way to China and India. This is going to result in shortage of bivoltine raw silk in the international market. Today, major part of the Indian silk is being categorised as 'H' grade — the poorest quality in the international market. On the otherhand, the bivoltine silkworms provide superior quality cocoons, higher yield and superior silk quality of international grade — a new platter on which our raw silk exports and earning of precious foreign exchange, are being planned. Under the world bank aided Karnataka Sericulture Project (1980-87), it was planned to produce a total of 4500 m. tons of raw silk, out of which 1000 m.tons were to be bivoltine raw silk. Though the total silk production of 4500 m.tons has been achieved, the target of bivoltine silk production has not yet been achieved.

The bivoltine cocoons are also required throughout the year as seed cocoons for the production of the popular cross breed silkworm layings which are being successfully reared on large scale in the maidan areas. Availability of good quality bivoltine seed cocoons throughout the year, plays a very crucial role in stabilizing cross breed cocoon productivity. At present, most of the bivoltine cocoons produced in the maidan areas of Karnataka, are being utilised as seed cocoons. The bivoltine cocoon yields in maidan areas are generally poor. These few sericulturists who are rearing bivoltine silkworms are doing so because of the attractive prices offered to seed cocoons. It is being realised that bivoltine silkworms need nutritious leaf, better rearing conditions, management and socio economic status of the sericulturist. However, in the Western ghats of Karnataka, there are several shining examples of success in bivoltine sericulture which shows the potentiality of these regions.

B. FAVOURABLE FACTORS:

For a successful havest of bivoltine cocoon crops, the contribution of various factors have been calculated in Japan as follows:

Climate	- 37.0%
Mulberry leaf	- 38.2%
Rearing technique	- 9.3%
Silkworm race	- 4.2%
Silkworm eggs	- 3.1%
Other factors	- 6.6%

This conclusion was based on six years data with 667 samples at the farmer's level, and was arrived at by **Dr. Matsumura** — a reputed Japanese sericulture scientist, highly respected by the Japanese sericulturists (Miyashita, 1986). However, the role of the above factors, under our agro climatic and socio economic conditions, may slightly vary. Nevertheless, the contributions of climate and mulberry leaf do play major roles, while the other factors can play only minor roles.

In Western ghats region, the rich forest soils, abundant soil moisture and

salubrious cool humid/warm humid climate are highly favourable for ensuring luxuriant mulberry growth with high quality nutritive leaf throughout the year. In addition, even during the peak summer, the relative humidity does not fall below 60%, the maximum temperature does not go beyond 35°C, and even evaporation losses are relatively low. This favourable climate combined with highly nutritious leaf supplied, constitute the major factors to ensure healthy growth of bivoltine silkworms to harvest bumper cocoon yields of superior quality.

The heavy rainfall season of 2-3 months from July-September in the region does not allow the rearing of silkworms. However, this becomes a blessing in disguise, as this season acts as a natural barrier for the multiplication of pathogens and uzi-fly pest of silkworms. This forced annual rearing holiday also brings in some orderliness in the number and schedules of silkworm brushings. This inturn helps in minimizing the cocoon crop losses and stabilising the productivity of superior quality cocoons in the region.

C. CHALLENGES AND APPROACHES TO OVERCOME THEM:

The sericulture technology in India has been developed primarily to suit the agroclimatic conditions of the traditional areas in the maidans. However, in this respect, the Western ghat regions are slightly different from those of maidan areas, which possess favourable as well as some unfavourable conditions for taking up sericulture. The major challenges in these regions are: 1. Heavy rainfall during July-September that brings in difficulties such as soil erosion, high soil moisture status, water logging, leaching of applied nutrients from the soil, increase in soil acidity, abundant weed growth, high levels of atmospheric humidity in the mulberry gardens as well as in the rearing rooms, high levels of leaf moisture and delay in leaf maturity and associated incidence of disease causing pathogens and pests on mulberry and to some extent on silkworms. Under intensive cultivation in the new environment, mulberry may be confronted with new diseases and pests. The unfavourable conditions are negligible compared to the favourable conditions in these regions and are not unsurmountable with the present level of the advancement in science and technology. There is a good scope to appropriately modify the existing technology suitable to the conditions in the Western Ghats.

1 As these regions are generally slopy and undulating, they are prone to soil erosion during the rainy season. Measures such as, contour terracing/bench terracing and planting rows of mulberry with elevated ridges across the slope, will have to be put into practice (Fig. 2).

2 Heavy rainfall often results in water logging in the mulberry plots. This combined with high soil moisture status and high humidity increases the chances of various root and stem diseases of mulberry. Making elevated ridges and low furrows, deep trenches around the plot and such other measures will help in draining out excess of water.

3 The establishment of a mulberry garden in these areas requires more effort and

attention compared to the maidan areas. The continuous heavy rainfall during July-September does not offer a suitable time for planting mulberry. If mulberry cuttings are directly planted into the field during June-July, the possibilities of the decay of the planted cuttings are more, resulting in many failed pits. In this situation, planting long cuttings of 25-30 cm length in elevated filled pits, to avoid water logging around the cuttings can be followed. Besides, it is necessary to develop a small nursery to raise saplings so as to replant the failed pits later.

In these areas, it is always advantageous and economical too, to raise saplings separately in a nursery during March-May and transplant well grown saplings of about 3 feet length to the pits during June, taking suitable measures for the drainage of excess water.

4 The heavy rains cause excessive leaching of salts and nutrients from the soil and the soil becomes highly acidic. Hence, it is necessary to introduce regular practices of soil testing and accordingly incorporate the soil corrective measures. Infact, the liming should form a standard practice in the mulberry cultivation practices in this region.

5 The luxuriant growth of mulberry combined with heavy rainfall, increases the humidity and prevents proper aeration in the mulberry garden. This condition is conducive for the incidence of fungal diseases such as powdery mildew, leaf spot, leaf rust, etc., rendering the leaf often unsuitable for feeding the silkworms. This could be improved by adopting suitable spacing and training methods of mulberry. It is desirable to increase the row to row distance to atleast 4 feet and increase the basal stump height to about 2 feet from the ground level (Fig. 3). This increases proper aeration and reduces humidity in the garden.

6 The increased stump height also prevents the soiling of bottom leaves due to heavy rainfall which otherwise become unsuitable for feeding silkworms.

7 During the heavy rainfall season, it is not possible to conduct silkworm rearing. Therefore, it is better to undertake annual base prunning (60 cm above the ground level) of mulberry during the month of July so that the plants can grow and be ready for harvest after the heavy rains.

8 It is not possible to apply farm yard manure/compost during the rainy season and if chemical fertilizers are applied, most of them are lost due to leaching. Further, as the soils of these regions are fertile with rich humus content, there is scope to modify the fertilizer dose for the sake of economy. Hence, there is need to work out the schedules and doses of fertilizers/ manures application for this region.

9 High soil moisture and high leaf moisture status delays the maturity of leaves so as to be suitable for the adult silkworms, suitable growth and harvesting schedules and methods will have to be standardized.

10 The copious availability of soil moisture encourages abundant weed growth, which often impedes the growth of mulberry in these regions. Weed control forms an important practice to ensure good growth of mulberry in the region. Therefore, it is desirable to grow dwarf

varieties of green manure crops during the rainy season in between the mulberry rows as an inter crop which cover the soil surface and act as a mat for high intense rains. Legumes such as Horse gram or **Mimosa invisa** (Thornless variety) and other dwarf varieties may be selected. On the other hand, during the non-rainy season, high bio-mass producing, short duration green manure crops such as, Sunhemp, Dhainche, may be grown as an inter crop, which can be mulched into the soil later at the time of its flowering. This practice of green manure inter crops not only reduces the weed growth, but also provides precious organic matter to the soil and fixes atmospheric nitrogen into the soil.

Measures like mulching of dried grass and unused tender mulberry stems can also be carried out to prevent weed growth.

11 At present, there is only MS variety of mulberry being grown popularly as bushes and it appears to be rather susceptible to powdery mildew and white root rot diseases under the Western ghat conditions. The MR variety, collected from Coonoor in Niligiris which is supposed to be Mildew resistant, can be tried under these conditions. There is a great need to select/develop new genotypes of mulberry suitable to the Western Ghats, to be grown as high bushes or low trees. Particular attention may have to be given to resistance of these genotypes to Mildew, root rot diseases and stem borers.

The Mulberry germ plasm banks at Central Sericulture Research & Training Institute, Mysore and Karnataka State Sericulture Development Institute, Bangalore, are maintaining a large number of indigenous and exotic genotypes which may have to be screened for their suitability to these conditions. Besides, there are a large number of mulberry trees found growing in old coffee plantations for a number of years, which seem to have acclaimatized to these conditions. Efforts must be made to collect them and evaluate them for their suitability to be grown as bushes or trees under the agroclimatic conditions of Western ghats.

12 High leaf moisture status and high humidity in the rearing atmosphere during the heavy rainfall season and occasional low rearing temperatures during rainy and winter seasons pose problems for silkworm rearing. Unless the desired rearing temperature and humidity are maintained, the larval duration and inturn the leaf consumption gets increased and tend to increase the chances of silkworm diseases. In such a case, measures such as providing good ventilation facilities for the rearing rooms, use of exhaust fans and room heaters and liberal use of lime to rearing bed during moulting and on the floor in the rearing rooms, will help in maintaining the required temperature and humidity. Besides, the use of lime and bleaching powder as disinfectants under these conditions may prove quite effective.

D. PRESENT STATUS OF SERICULTURE IN THE WESTERN GHAT REGION:

The development of sericulture, in the Western ghat region, particularly that of Karnataka, started during the later part of

the 5th Five Year Plan itself under the Western Ghat Development Programme. Because of the existance of good infrastructure, assured cocoon market and its long tradition of sericulture in Karnataka, sericulture took strong footing in the Malnad areas. Under the Karnataka Sericulture Project, two districts namely, Hassan and Shimoga of Malnad region were included, where good infrastructure facilities, two large model grainages, two cocoon markets and extension facilities have been developed. In addition, a research substation for Malnad region has also been established at Thirthalli (Shimoga district).

At present, in the 7 Western ghat districts of Karnataka, mulberry is being cultivated in about 7500 hectars & about 850 tonnes of cocoons are being produced (Table-2). Most of the bivoltine crops of Karnataka are being reared in these districts. The productivity of these bivoltine crops is very high and the quality of the cocoons particularly for seed is superior, which fetch higher price and are preferred over others for the production of cross breed layings. The bivoltine rearers in these areas have broken many records such as:

1. Maximum cocoon yield/100 Dfl's.
2. High cocoon yield/unit area.
3. Lowest number of cocoons/Kg of cocoons and
4. Maximum income/unit area.

In the Konkan region of Maharashtra, sericulture development was taken up during the 6th Five Year Plan under the Western ghats development programme. Mulberry cultivation and silkworm rearing were also taken up However, due to lack of proper infrastructure, assured market and knowledge of rearing technology, sericulture could not stabilized. Now, the Central Silk Board and the state government are making efforts to develop the required infrastructure and it is being proposed to develop about 5000 acres of mulberry in the next five years.

In Kerala, some efforts were made during 1970's to develop sericulture. Now ,it is well established that sericulture could be developed in almost all the districts of Kerala and in the districts of Palghat, Iddukki, Kasargod, Wayanad, many farmers have taken to sericulture and are harvesting rich yields of mulberry and cocoons. Mulberry is being cultivated in about 80 acres in Palghat district and in about 90 acroes in Idukki district. The Central Silk Board, the state government and many voluntary agencies are making efforts to develop about 2500 acres of mulberry and required infrastructural facilities, silk reeling units and extension facilities. The survey conducted in Kerala state revealed that about 9650 acres could be conveniently brought under mulberry in low land, mid land and up land areas of all the 14 districts (**Venugopal Pillai,** 1987).

In Tamilnadu, sericulture is developing very fast and during the last decade (1977-87) the area under mulberry increased by 472.38% and raw silk production increased by 540.71%. In the seven Western ghat districts of Tamilnadu, mulberry is being grown in about 29,312 acres (**Thangavelu,** 1987). The Central Silk Board has its Regional Sericulture Research Station established in 1961, at Coonoor in Niligiri Hills and the bivoltines were introduced there in the early eighties. Many farmers in Niligiris are carrying out bivoltine sericulture successfully in about

100 ha. of mulberry even upto 6000 feet above M.S.L. Already some enterprising ten planters have planted mulberry as shade trees as well as pure mulberry in tea plantations. There is good potential to develop about 1000 hectares under pure mulberry in the Niligiri ranges for bivoltine sericulture. The entire bivoltine seed cocoon requirements of Tamilnadu could be produced in the Niligiri ranges (**Satyanarayana Raju** and **Chandra-shekhariah,** 1987). The government of Tamilnadu is finalising a huge World Bank aided project for sericulture development in the state.

V. STRATEGIES FOR BIVOLTINE SERICULTURE DEVELOPMENT IN THE WESTERN GHATS.

A. INTEGRATED MULTIPLE CROPPING SYSTEMS:

The Western ghats region covers an area of 1.06 lakh sq. kilometers and supports a population of 38.85 millions (1981 census, Table-1). Major crops grown in this region are plantations of coffee, tea, coconut, arecanut, banana, pepper, cardamum, etc., and paddy is generally grown in low lands. In the Malnad areas of Karnataka, coffee forms the major plantation crop, covering an area of 114,978 hectares.In the Nilgiri, Palaney and Annamalai ranges of Tamilnadu, tea forms the major crop, followed by coffee, constituting 48% and 16% respectively of the total area under cultivation. In Kerala, coconut forms the major plantation crop, covering an area of 692,945 hectars, followed by coffee, rubber, tea, etc. Besides, multiple cropping systems of cash crops of high value such as, coffee with pepper, cardamum, cocoa, oranges, citrus, etc. arecanut with banana, pepper, bettle vine, cardamum, cocoa, etc., are very popular. In degraded lands, crops such as coconut, cocoa, cardamum, banana, etc., are also being developed.

In such multiple cropping system, integrated approaches towards developing bivoltine sericulture in these plantations will open new avenues of development. The long gestation period required and the erratic fluctuations in the prices of plantation crops, tend to encourage the planters to opt for subsidiary crops requiring less investment, short gestation period, assured market and assured income at regular short intervals. It is in this context, sericulture becomes ideally suited as a lucrative subsidiary occupation to planters. Thus, newer integrated traditions of "COFFEE-SILK/TEA/SILK/COCONUT-SILK/SILK-VEGE-TABLES" will have to be encouraged and established.

In the Western ghat region, there are about 205,643 hectares of coffee plantations, with 98,847 registered coffee growers and about 97% (92,950) of them are small growers holding less than 10 acres (coffee guide, 1985). Besides, tea is also being cultivated in about 75,000 ha. in this region and majority of them are small growers. Even if, every planter takes atleast one acre of monoculture of mulberry, it is possible to produce about 25,000 m tonnes of bivoltine cocoons per annum.

In the Malnad areas of Karnataka, already 300-400 enterprising coffee planters have taken lead in this direction by taking monoculture of mulberry in coffee estates and are harvesting bumper crops of bivoltine cocoons of high quality. Similarly, in Nilgiri ranges, some tea planters have taken up mulberry

sericulture along with tea very successfully. In maidan areas, growing mulberry along with coconut is very popular and is paying very rich dividents to the farmers.

B. SUITABILITY OF THE PLANTERS AND THE PLANTATION ESTATES FOR BIVOLTINE SERICULTURE:

The agroclimatic conditions prevailing in coffee and tea plantations of Western ghat regions are ideally suitable for rearing bivoltine silkworms, as even the rain fall is sufficient and not very heavy for mulberry cultivation.

2. In the plantation area, with an altitude of 2500-4500 feet above M.S.L., mulberry grows throughout the year and 4-5 leaf harvests can be easily taken and inturn 8-10 rearings can be carried out per annum, depending on the local conditions.

3. Generally, in the plantation estates, large tracts of unused lands and other vacant places are available, which can be efficiently utilized for planting mulberry.

4. The infrastructure available with the planters such as, buildings for rearing, agriculture implements, wood and bamboo materials for rearing appliances and the labour force available with them, are more than adequate. This can drastically reduce the investment required for taking up sericulture.

5. Except for the harvesting season of 2-3 months, they have sufficient leisure time in other seasons which could be fully utilised for silkworm rearing as a hobby.

6. The houses and the villages in these regions are invariably isolated and are far off which act as natural barriers for the spread of silkworm pathogens.

7. The socio economic status, literacy and their expertise in the management of large plantations and labour, came very handy and become an asset for taking up sericulture.

8. Sericulture provides additional stable income at regular monthly intervals in a year, while the plantation crops provide only an annual income.

Thus, all the above factors combined with most favourable agro-climatic factors are ideally suited for planters to harvesting bumper crops of bivoltine cocoons in these areas.

C. APPROACHES FOR MULBERRY CULTIVATION:

In the traditional maidan areas, mulberry is grown exclusively as a bush. However, in the Western ghats, mulberry can be grown in several ways. They are as follows:

Monoculture of mulberry as bush- in vacant lands.

Inter crop of mulberry bushes in new coconut gardens.

As a lower canopy, temporary shade tree, inter cropping with coffee and tea in the plantations

As pure tree, in the vacant places in the plantation estates

As pure trees in non arable and degraded lands, and also in the forest areas, under the social forestry and the waste land development programmes.

Monoculture of Mulberry as bushes:

In the plantation of mulberry as bushes there is good possibilities of growing short duration crops of vegetables, fodder and

IN SLOPY LANDS
(Rows across the slope)

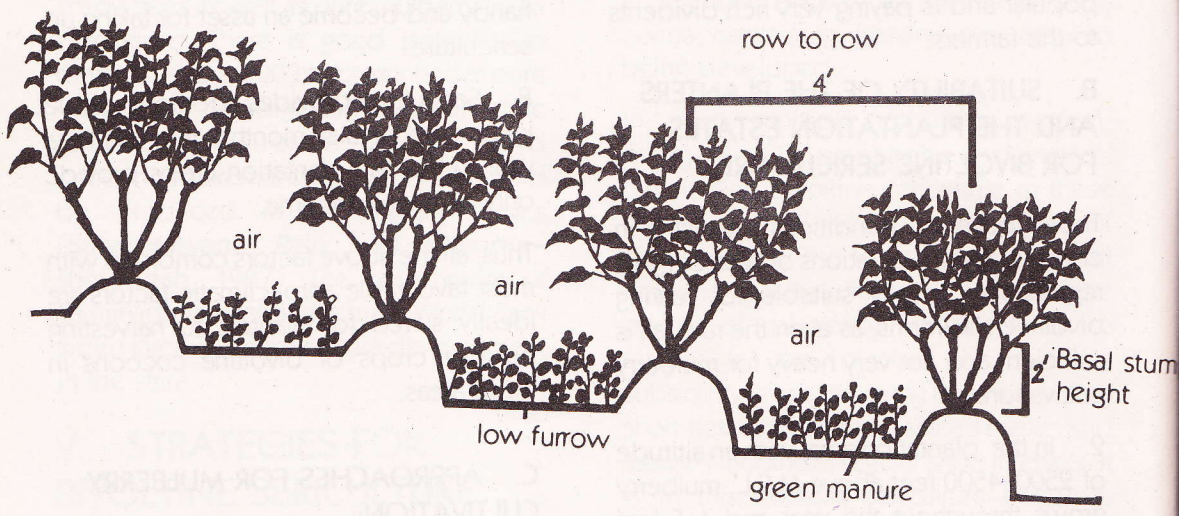


Fig. 2

IN LEVEL LANDS

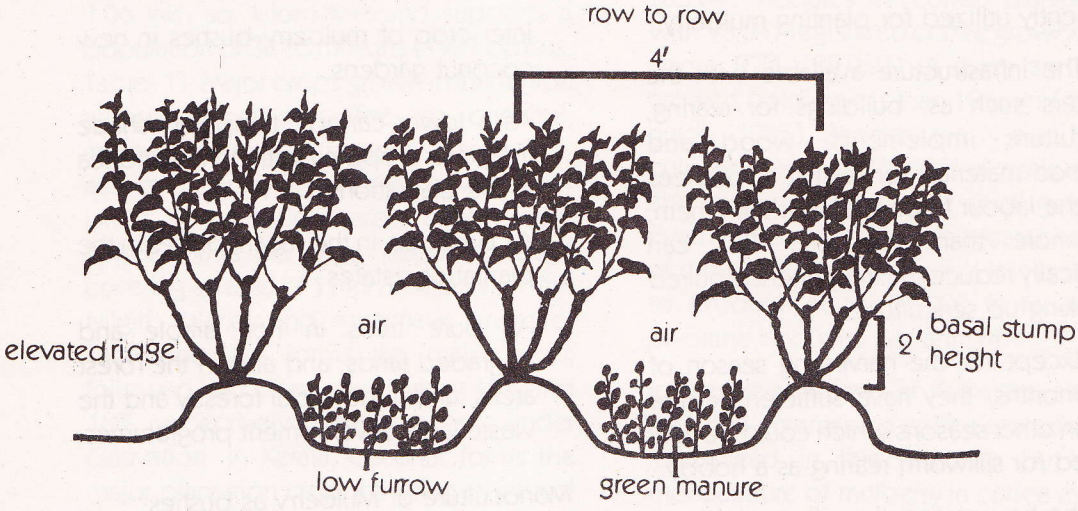


Fig. 3

green manure, in between the rows of mulberry, because of the copious availability of water and fertile soils. In this approach of "integrated mulberry farming systems," the scarce natural resources of soil, water and land could be utilised efficiently to improve the productivity and income per unit area. Besides, the soil organic matter and soil productivity could be maintained, at higher levels. Further, the growth of weeds could be reduced. However, several aspects such as, the spacing and planting system of mulberry, suitable varieties of inter crops for different seasons, the fertilizer schedules and doses, and plant protection measures, will have to be standardised.

It is always desirable to start with one acre of monoculture of mulberry and after getting sufficient experience and confidence, additional two acres could be taken up during the third year. However, with the expertise of managing large plantations, the planters could even go for another two acres of mulberry during the 5th year. It is advisable not to go beyond 5 acres of mulberry, because of its intensive nature and inherent difficulties in management.

As Pure Trees in Vacant Places:

In the estates or plantations, large areas are utilised for roads, fencing, buildings, drying yards etc., where mulberry can be grown as trees, with a distance of 6-8' and trained to a crown height of about 4-5'. Even as few as 250-300 well grown trees of 3-4 years old can give leaf sufficient to take up rearing of about 100 DFL's at a time, that can produce an average of about 40 kgs of cocoons, which can fetch about 7000-8000 rupees per year. This can be easily managed by a house-wife, with little support from one or two labourers in their spare time.

As an intercrop of shade tree for the plantation crops:

Mulberry trees possess all the desirable characters required for a good lower canopy temporary shade tree for coffee and tea plantations. It is easy to propagate by means of cuttings or saplings. It is fast growing, deep rooted, withstands frequent loppings and later regenerates with much more vigour; provides additional income through silkworm rearing; supplies fuel wood, leaf mulch, supplimental cattle feed etc. It does not have serious incidence of pests and diseases. Plantation crops in general require a much longer gestation period, during which much expenditure is involved in their maintainance. It is because of this reason, that the extension of new plantations are smaller in extent and slower. Mulberry, when grown as a shade tree in new plantation, can start giving additional income at regular intervals, after the first year itself, which can be made use of for the maintanance of new plantation under gestation.

Perhaps, this approach may tend to increase the extension of news plantations. However, detailed agronomies of growing mulberry as a shade tree with coffee or tea will have to be standardised. For the time being, the mulberry and coffee/tea scientists will have to work out, tentative guidelines, that could be put into practice immediately, before the detailed practices are standardised. Aspects such as, spacing of mulberry in relation to plantation crops, the crown height; the training of mulberry tree, methods and extent of harvests in

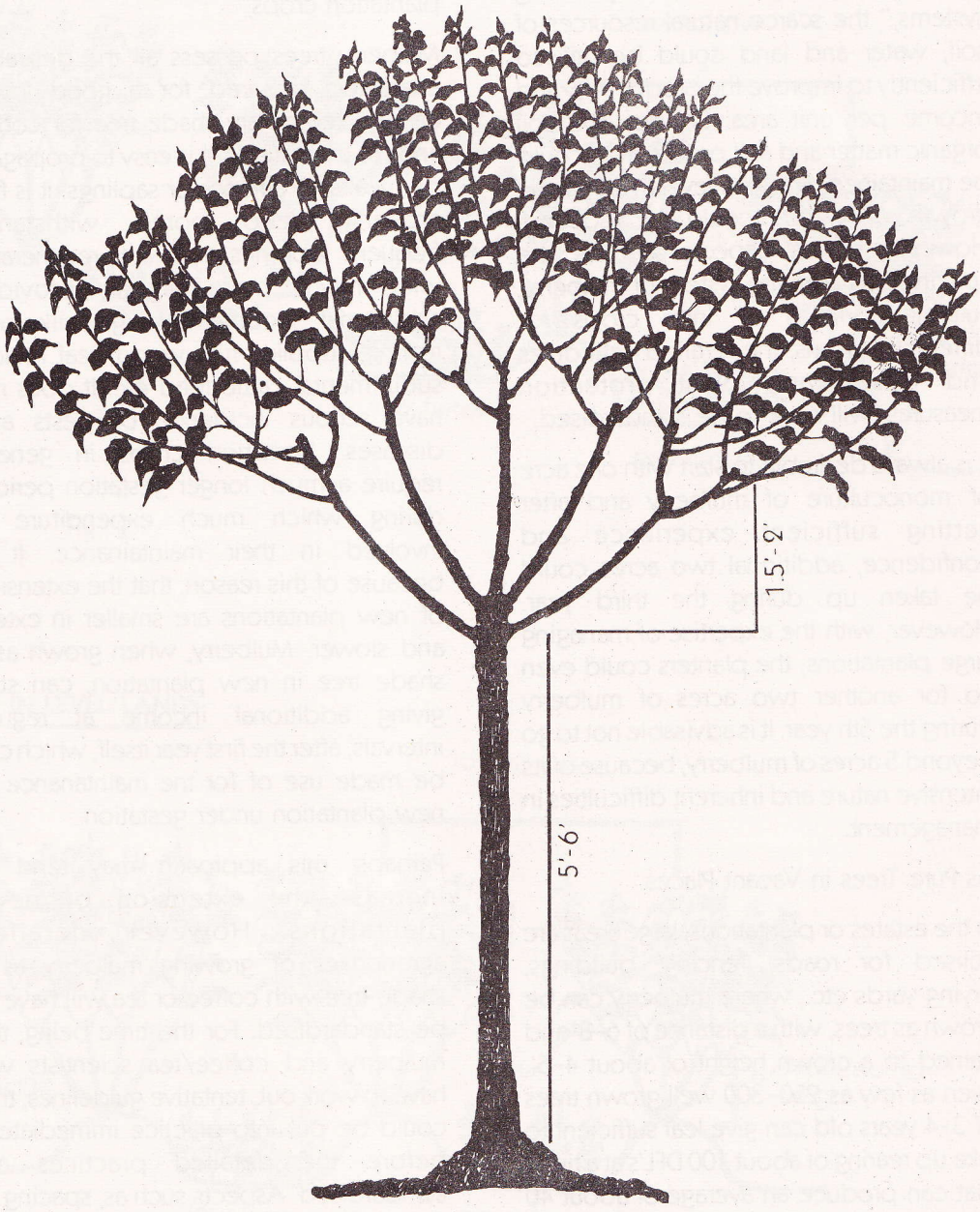


Fig. 4 TRAINING AS LOW TREE

different seasons so as to provide the required shade. Fertilizers schedules and doses for mulberry as an inter crop, effects of fungicidal/insecticidal sprays of plantation crops on mulberry leaves for silkworm rearing, and other related aspects affecting this integrated approach, will have to be studied in detail.

D. MEASURES TO ENCOURAGE BIVOLTINE SERICULTURE:

* For the development of any industry, its product should enjoy good marketability and should be preferred by the consumers. Though the bivoltine cocoons are superior with regard to their silk content and silk quality, the silk reeler who constitutes the immediate consumer does not prefer bivoltine cocoons and does not offer attractive prices to them over the cross breed cocoons. The main reason is that with the technology and infrastructure available with them, the Indian silk reelers can not recover high silk content from the bivoltine cocoons and the renditta in such cases invariably goes up. Unless appropriate bivoltine cocoon reeling technology and infrastructure suitable to our conditions is developed, bivoltine cocoons can not enjoy much demand and bivoltine sericulture can not be developed. This infact constitutes the major limiting factor which has to be overcome on a priority basis.

* Western ghats region should be declared as a bivoltine region by a suitable legislation so that only bivoltines are reared throughout the year and rearing of all other races of silkworms are banned in this region. The present 162 taluks included in the Western ghats region are demarcated adopting the criterion of elevation of the areas 600 meters above M.S.L. However, for the purpose of bivoltine sericulture development, the criterion of agroclimate should be taken into consideration and accordingly areas in the Western ghats having favourable agroclimate for rearing bivoltines throughout the year should be demarcated upto taluk level or preferably upto C.B.C. level.

* In the maidan areas, rearing of bivoltine in certain favourable seasons with selected rearers appears to be more practicable, as the dry months of March to June are found unsuitable for producing good quality mulberry leaf and also for bivoltine rearing. Depending on the local agroclimates, suitable rearing seasons preferably between August-February will have to be utilised for bivoltine rearing in the maidan areas.

* It is highly advantageous to gradually shift the entire bivoltine seed rearings to some selected parts of Western ghats and with some selected sericulturists, so that high seed cocoon quality and their assured supply in all the seasons are ensured to the grainages. This results in high quality eggs which can stabilise and increase commercial cocoon productivity and reduce crop losses.

* The existing bivoltine races are too few and their performance in the field is not entirely satisfactory. More emphasis and encouragement should be focussed to develop few more improved bivoltine races having specific traits of hardiness,

suitability to specific agroclimates, seasons and so on. This can enable the sericulturists to select the races or hybrid combinations of their choice.

* At present, the price difference between the bivoltine cocoons meant for seed and those for reeling is too wide. This difference further increases during the summer months, irrespective of quality, due to shortage in their availability. This disperity between the bivoltine reeling cocoons and the bivoltine seed cocoons will have to be maintained at about 20-25% and the rate of seed cocoons has to be fixed based on better scientific standards.

* In the new sericulture areas of Western ghats, particularly that of Maharashtra, Kerala and Tamilnadu, good infrastructural facilities, sound extension organisation, marketing facilities for cocoons and silk, silk reeling and weaving units and so on, have to be developed side by side. In addition to the crucial roles played by the Central Silk Board and the state governments in organising the industry, voluntary organisations can also play a very significant role in encouraging sericulture in these areas, which should be fully utilised.

E. RESEARCH PROGRAMMES OF IMMEDIATE IMPORTANCE:

The research programmes that require immediate attention for this region are as follows:

a. Establishment of mulberry as bushes or trees.

b. Optimum spacing and suitable planting system to overcome the problems of soil erosion and water logging.

c. Methods of training mulberry as high bushes or low trees, under the monoculture practices and also as shade trees in plantation crops.

d. Weed control measures.

e. Dosage and schedules of fertilisers.

f. Management of acidic soils for mulberry.

g. Agronomics of inter cropping of mulberry trees with plantation crops particularly coffee and tea.

h. Agronomics of growing short duration crops of vegetables, green manure and fodder as inter crops under mulberry bush cultivation.

i. Selection and breeding genotypes of mulberry suitable to be grown as bushes or trees under these conditions.

j. Suitable harvesting and prunning methods of mulberry bushes and trees.

k. Designing of suitable rearing houses to regulate humidity and temperature.

l. Measures to reduce rearing room humidity.

m. Appropriate disinfection measures.

n. Appropriate bivoltine cocooon reeling technology and infrastructure development, suitable to the conditions of our silk reelers.

TABLE-1: THE STATISTICS OF THE TALUKS INCLUDED IN THE WESTERN GHATS REGION:

Sl. No	State & district	No. of taluks	Total area in sq.kms.	Total population (1981 census) in '000
I.	**MAHARASHTRA STATE:**			
1.	Dhule	2	3317.8	430
2.	Nasik	8	9532.4	1728
3.	Thane	5	4712.2	556
4.	Pune	9	9807.0	1609
5.	Raigad	7	4299.4	733
6.	Satara	8	6747.4	1287
7.	Ratnagiri (north)	5	5433.82	833
8.	Ratnagiri (south)	5	3665.4	529
9.	Sangli	1	637.2	131
10.	Kolhapur	10	7091.3	1957
11.	Ahmednagar	2	3168.0	456
	Sub total	62	58411.92	10249
II.	**KARNATAKA STATE:**			
1.	Belgaum	5	6450.95	1488
2.	Dharwad	1	1082.96	160
3.	North Kanara	9	8637.91	881
4.	Shimoga	5	6592.7	832
5.	Chickmagalur	5	4412.4	408
6.	Hassan	4	3137.11	594
7.	South Kanara	6	7073.04	1500
8.	Kodagu	3	4084.25	460
9.	Mysore	2	2792.98	340
	Sub total	40	44264.30	6663
I.	**TAMILNADU STATE:**			
1.	The Nilgiris	4	2542.5	699
2.	Coimbatore	5	2542.5	629
3.	Periyar	1	2211.0	412
4.	Madurai	6	8222.6	2227
5.	Ramanathapuram	3	2050.6	801
6.	Tirunelveli	4	2991.5	816
7.	Tirunelveli sub region	2	3116.1	765
8.	Kanyakumari	4	1571.814224	
	Sub total	29	27926.0	9539

Sl. No	State & district	No. of taluks	Total area in sq.kms.	Total population (1981 census) in '000
IV.	**KERALA STATE:**			
1.	Cannanore	3	3525.9	1756
2.	Wynad	3	2125.7	554
3.	Kozhikoda	3	2333.3	2245
4.	Malappuram	1	2176.6	944
5.	Palghat	3	3061.0	1068
6.	Trichur	1	1316.0	674
7.	Ernakulam	3	1396.2	791
8.	Idukki	4	5126.7	971
9.	Kottayam	2	1114.3	588
10.	Quilon	4	4150.8	1628
11.	Trivandrum	2	1497.8	1171
	Sub total	29	27824.3	12390
V.	**GOA STATE:**			
1.	Goa	3	1724.3	133
	GRAND TOTAL	163	160150.82	38974

TABLE-2: PRESENT STATUS OF SERICULTURE IN THE WESTERN GHAT DISTRICTS OF KARNATAKA

Sl. No	Districts of Western ghats	Area under mulberry (Ha.) 1986-1987			Estimated cocoon production (tonnes) 1986-1987
		Irrigated	Rainfed	Total	
1.	Belgaum	636	23	659	137
2.	Dharwad	1950	-	1950	189
3.	North Kanara	373	55	428	54
4.	South Kanara	244	218	462	47
5.	Shimoga	950	-	950	117
6.	Chickmagalur	250	30	280	43
7.	Hassan	2250	240	2490	233
8.	Coorg	20	98	118	21
	TOTAL	6673	664	7337	841

TABLE-3 SUITABILITY OF THE AGROCLIMATIC CONDITIONS OF WESTERN GHATS REGION FOR BIVOLTINE SERICULTURE

Favourable	Unfavourable
1. Rich fertile soils with high humus content.	1. Heavy rain-fall.
2. Abundant availability of water through out the year.	2. Soil erosion, water logging and leaching of applied fertilizers during the rainy season.
3. Cool humid/warm humid climate.	3. High soil acidity.
4. Even during the peak summer, the maximum temperature does not go beyond 35°C, humidity does not go below 60%, and even the evaporation losses are less	4. Non availability of proper time for mulberry planting
5. This moderate agro climate is highly suitable not only for the luxuriant growth of mulberry with nutritious quality leaf, but also for the healthy growth of - bivoltine silk worms.	5. Establishment of - mulberry garden is relatively tedious.
6. The high rainfall season of July-September - enforces annual rearing holiday, which acts as a natural barrier for the multiplication of silkworm pathogens and uzifly pest.	6. Abundant weed growth.
	7. High leaf moisture status.
	8. Slower maturity of leaf.
	9. High atmospheric humidity during the rainy season.
	10 Temperature decreases below optimum for silk worm rearing during some parts of the night in winter season.

VI. CONCLUDING REMARKS:

It is well established that the Western ghats region possess high potential for the development of bivoltine sericulture to usher in "White Silk Revolution" in India. Highly favourable eco-climatic conditions and the availability of enterprising and educated farmers and planters of better socio-economic status in this region, have to be fully exploited for achieving high productivity of bivoltine cocoons of good quality to produce international grade of silk in the country.

There is an urgent need to standardize appropriate technology suitable to the designed strategies of development and to these conditions. It is also required to develop mulberry genotypes and silkworm races suitable to these regions. Therefore, establishment of a sound research and development organisation exclusively for this region becomes a basic requirement. The existing facilities may prove too inadequate.

Farmers are the greatest inventors of practical value. It is often they, who show newer leads in agriculture, as has happened in the case of introduction of sericulture in coffee estates. It is the duty of the scientists to bring in improvements and stabilisation in their new endeavours. This could be done only by close interaction of scientists with the farmers.

So far, various crop scientists have been working in isolation. With the development of these new integrated approaches, new vistas are being opened for the involvement of various plantation crop scientists with the sericulture scientists in collaborative research programmes for the benefit of the rural farmers.

Now is the right time for the Central Silk Board and the respective state departments to take up suitable schemes, to enlighten the planters and other farmers in this region, about the advantages of sericulture, to encourage them to take up sericulture, to provide required training, to develop strong infrastructure and extension and research back up.

Sericulture can never be a competition to the plantation crops. On the other hand, it helps to stabilise the economy of the planters and acts as an insurance against the fluctuations in the prices of plantation crops. With this realisation, the organisations such as the Coffee Board, Tea Board and Central Silk Board should come forward and join hands to encourage such integrated endeavours.

ANNEX-III

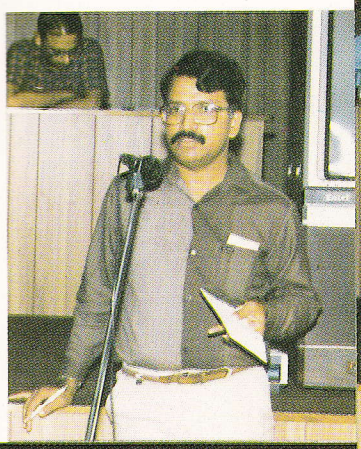
MEETING ON PROSPECTS OF SERICULTURE IN TEA AND COFFEE PLANTATIONS PROGRAMME

9th October, 1987

10.00-10.05	Invocation
10.05-10.10	Welcome address by Dr. K. Sengupta, Director, Central Sericultural Research & Training Institute, Mysore.
10.10-10.30	Introductory remarks by Shri V. Balasubramanian, I.A.S., Member-Secretary, Central Silk Board, Bangalore.
10.20-13.30	Speeches by participants
13.30-14.30	Lunch
14.30-15.30	Visit to laboratories and field
15.30-16.30	Tea and screening of films on sericulture
16.30-17.30	Discussions

10th October, 1987

08.30	Leave Mysore
10.30	Reach Ramanagaram
10.30-11.30	Visit to cocoon market
11.30	Leave Ramanagaram
12.00	Reach Asheervanam
12.00-12.30	Visit to Asheervanam Benedictine monastery
12.30	Leave Asheervanam for Bangalore
01.00-2.30	Lunch
03.00	Dispersal with thanks to the organizers.

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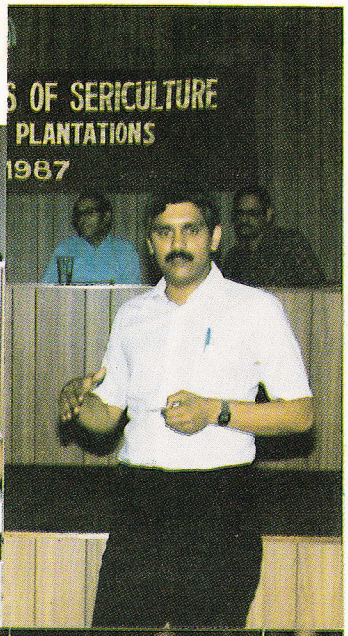
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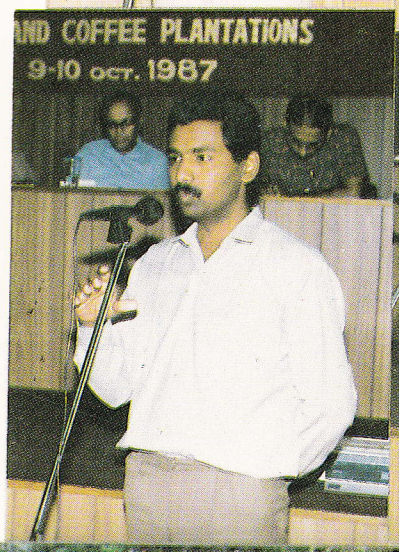
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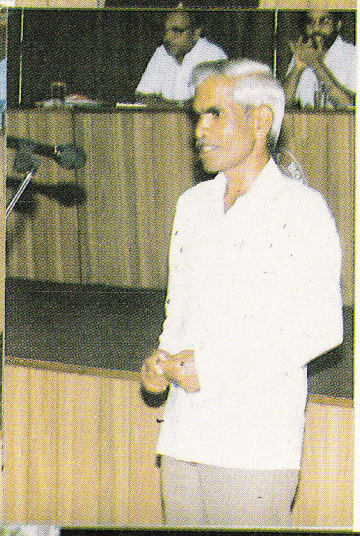

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