The extent of adoption of scientific muga culture technology by the muga rearers of the Sonitpur district of Assam, India

Authors' contributions:- This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Abstract

A study was conducted in the Sonitpur district of Assam, India, to assess the level of adoption of improved technologies among 120 muga farmers. Adoption of the scientific muga culture practices by the silk cultivators has direct relation with the yield production. It was found that majority (65.83%) of the muga rearers demonstrated a medium level of adoption, with 14.17% exhibiting a low level and 20.00% demonstrating a high level of adoption of scientific muga culture technology. Intercultural operation, brushing of newly hatched worms during morning hours of the day, avoiding frequent handling of worms, selection of well-formed good cocoons for seed production as well as for reeling purpose and collection and destruction of diseased larvae and removal of affected twigs /shoots from the field are some of the practices fully adopted while use of improved mounting device for cocooning, spraying of 0.01% sodium hypochlorite solution as a disinfectant on the foliage 4 days before brushing, stifling the cocoon in hot air oven and use of new technologies and machines for re-reeling, weaving etc. were not followed by the muga farmers.

Keywords: Muga culture, Adoption, Rearers, Brushing, Disinfectant

1. Introduction

Muga culture represents a longstanding traditional practice among rural communities in Assam, serving as a pivotal component of the local economy, particularly for small and marginal farmers. This practice holds significant potential for socio-economic advancement, facilitating sustainable income generation within rural populations, [1]. Sonitpur district in Assam is a prominent hub for silk production, with a substantial segment of the rural populace reliant on sericulture for their livelihoods. Muga silk, also known as golden silk, stands as a source of pride for Assam and is deeply entrenched within Assamese culture. It is believed that the Tai-Ahom's introduced muga culture to Assam, thereby making a noteworthy contribution to the region's cultural heritage, [2]. Assam's favourable weather and climatic conditions render it an ideal locale for muga culture. The production and productivity of muga culture primarily hinge upon the adoption of contemporary technologies

[3,4]. Over the past two decades, various advanced technologies related to muga culture, including the cultivation and management of muga host plants, production of disease-free laying (dfl), silkworm rearing at early and late stages, prophylactic measures against pests and diseases, and improved mountage for cocoon spinning have been developed and recommended for the benefit of farmers [5]. Nevertheless, despite a consistent upward trajectory in the production of muga raw silk, it continues to lag behind its potential production. A result highlighted a significant yield gap of 50% in seed and 30% in commercial crop between demonstration centres and farmers engaged in muga culture, [6]. Additionally, observed that the non-adoption or low adoption of improved technologies among farmers leads to a reduced production of 20-40 cocoons per laying, as opposed to 50-60 cocoons per laying by technology adopters, [7].

Therefore the present study was undertaken with the objectives to evaluate the extent of adoption of the scientific muga culture practices in the Sonitpur district of Assam.

2. Materials and Methods

The current study was conducted purposively in the Sonitpur district of Assam during 2020–2021, for 2 years with a sample size of 120 respondents. A multistage sampling design was employed to select the respondents for this study. Total 40 respondents from each of the three development blocks *viz.* Naduar, Balipara and Borchala block were selected. Development blocks were selected based on the numbers of muga rearers. Two villages from each selected development block were chosen; Niz-Borchala and Borjhar from Borchala Development Block, Dharikati and Chariduar from Balipara Development Block, and Hatinga and Tupia Gaon from Naduar Development Block, for the study. The adoption of silkworm-rearing practices was assessed by constructing a structured schedule based on the package of practices for muga rearing. Scores of '0', '1', and '2' were assigned to denote non-adoption, partial adoption, and full adoption, respectively. Respondents were categorized as having low, medium, or high adoption of improved technologies based on the extent of adoption, determined using mean and standard deviation. Statistical techniques such as simple frequencies, percentage, mean and standard deviation were calculated for data analysis and interpretation.

3. Results and Discussion

3.1 Distribution of the muga rearers in adoption of scientific muga culture technology

The data presented in the Table 1 revealed that the majority (65.83%) of the muga rearers demonstrated a medium level of adoption of scientific muga culture technology, while 14.17% exhibited a low level of adoption, and 20.00% exhibited a high level of adoption.

Table 1. Distribution of the muga rearers according to their overall extent of adoption in scientific muga culture technology (n=120)

Sl No.	Category	Range	Frequency	Percentage	Mean	S.D.
1.	Low	Below 43.09	17	14.17		
2.	Medium	Between 43.09 and 68.40	79	65.83	55.75	12.65
3.	High	Above 68.40	24	20.00		

Similar findings were reported that the overall socio-economic condition of the muga rearers in Assam was unsatisfactory. Furthermore, their study revealed that well-educated farmers with a strong understanding of improved sericulture technologies tended to adopt recent technologies to some extent, [4]. To enhance the transfer and adoption of recent technologies, effective extension programs are deemed necessary. Similar study found that majority of the sericulturists exhibited a medium level of adoption of sericulture practices in the Aurangabad district of the Marathwada region, [8]. Also observed that majority of the farmer belonged to medium adoption category with respect to sericulture production technologies in Bidar district of North Karnataka, [9].

3.2 Extent of adoption of package of practices for raising host plants

The data presented in Table 2 indicates significant disparities in the adoption of scientific practices among the muga rearers. Specifically, the majority (80.00%) of the rearers did not adopt the scientific practice of seed collection and selection, with only 13.33% partially adopting and a mere 6.67% fully adopting this practice. Similarly, concerning the proper method of seed sowing and raising of seedlings, the majority (42.50%) did not adopt it, while 24.17% partially adopted and 33.33% fully adopted the practice. However, regarding maintaining proper spacing between the host plants, a majority (81.67%) fully adopted the practice, with 18.33% partially adopting it. Similar study reported that more than ninety percent of famers have good knowledge regarding maintaining proper spacing between the muga host plants in different lower and upper district of Assam, [10]. Nutrient management was predominantly adopted by 46.67% of the rearers, with 27.50% partially adopting it and 25.83% not adopting it at all. Conversely, in disease and pest management, 76.67% of the rearers did not adopt the practices, while 23.33% partially adopted them. Regarding timely

pruning of host plants, the majority (55.00%) did not adopt the practice, with 34.17% partially adopting and 10.83% fully adopting it. However, all the rearers fully adopted intercultural operation practice.

Table 2. Distribution of the rearers on the basis of adoption exhibited to package of practices for raising host plants (n= 120)

Sl. No.	Package of practices of raising host plants	Full adoption		Partial adoption		No adoption	
		Frequency	%	Frequency	%	Frequency	%
1.	Seed collection and selection	8	6.67	16	13.33	96	80.00
2.	Seed sowing and raising of seedlings	40	33.33	29	24.17	51	42.50
3.	Maintaining proper spacing between the host plants in the main field	98	81.67	22	18.33	0	0
4.	Nutrient management	56	46.67	33	27.50	31	25.83
5.	Disease and pest management	0	0	28	23.33	92	76.67
6.	Timely pruning	13	10.83	41	34.17	66	55.00
7.	Intercultural operation	120	100.00	0	0	0	0

The poor adoption of the package of practices for raising host plants may be attributed to various factors, including the lack of proper guidance, high costs associated with chemical fertilizers and pesticides, delayed availability of inputs and reluctance to embrace new technologies. The constraints faced by sericulturists in adoption of sericulture production technology in Ahmednagar district of Maharashtra were sudied and found that insufficiency of capital, high cost of chemical fertilizer, lack of knowledge about concentration etc. were the major constraints faced by the farmers in the district in adoption of sericulture technologies, [11]. Similar result revealed that majority of the respondents comes under the low category of adoption about cultivation practices of mulberry and cocoon production under sericulture in Solapur [12]. Furthermore, the understanding of proper spacing, timely pruning, nutrient management and disease and pest management is influenced by factors such as education levels, socio-economic status, social engagement, exposure to mass media and contact with extension services.

3.3 Extent of adoption of package of practices for muga silkworm seed production technology

From the Table 3, it is evident that a majority (44.17%) of the rearers exhibited partial adoption of seed production technology for disinfection of grainage houses, while 40.00% did not adopt the practice at all, and only 15.83% fully adopted it. Similar results also reported that majority of the eri rearers exhibited partial adoption of seed production technology for disinfection of grainage houses in Jorhat district of Assam, [13]. Regarding the examination of mother moths for dfls ????where ??? production, 17.50% fully adopted the practice, 36.67% partially adopted it, and 45.83% did not adopt it. Conversely, for surface sterilization of eggs as part of the seed production package, 20.83% fully adopted the practice, 31.67% partially adopted it, and 47.50% did not adopt it.

Table 3. Distribution of the rearers on the basis of extent of adoption exhibited in using scientific method of muga silkworm seed production technology. (n=120)

Sl. No.	Seed production technology	Full Adoption		Partial Adoption		No Adoption	
		Frequency	%	Frequency	%	Frequency	%
1.	Disinfection of grainage house	19	15.83	53	44.17	48	40.00
2.	Mother moth examination for dfls production	21	17.50	44	36.67	55	45.83
3.	Surface sterilization of eggs	25	20.83	38	31.67	57	47.50

The partial adoption of improved technologies in seed production may stem from several factors. Firstly, there might be a lack of knowledge regarding disinfection methods and the necessary chemicals required for the process. Additionally, the high cost associated with acquiring a microscope for conducting mother moth examinations to produce disease-free layings could hinder the full adoption of the practice.

3.4 Extent of adoption of package of practices for rearing muga silkworm

From the Table 4, it can be inferred that 26.67% of the rearers fully adopted the practice of considering only 1-3 days hatched worms for rearing, while 35.00% partially adopted it and 38.33% did not adopt it at all. Moreover, a majority (57.50%) of the rearers did not adopt the practice of wrapping the tree trunk with oil-coated polythene sheets, followed by 35.00% who partially adopted it, and 7.50% who fully adopted it. Additionally, all the

rearers fully adopted the practice of brushing *kharikas* during the morning hours, and a majority (87.50%) fully adopted brushing *kharikas* in the right direction. Concerning the brushing of 2-3 dfls per plant, a majority (63.33%) fully adopted the practice, while 21.67% partially adopted it and 15.00% did not adopt it at all. Similarly, regarding the transfer of only healthy and uniformly moulted worms to new plants, a majority (51.67%) partially adopted the practice, followed by 34.17% who fully adopted it and 14.17% who did not adopt it.

Furthermore, all the rearers fully adopted the practices of handling worms and almost all the rearers fully adopted avoiding overcrowding of larvae in *chaloni* as well as in new plants. However, concerning the separation of uzi fly-infested larvae in different mountages, only 34.17% fully adopted the practice, while 31.67% partially adopted it and 34.17% did not follow the practice at all. Similarly, 70.83% of the rearers fully adopted the practice of using twigs with semi-dried leaves for cocoon formation, while 29.17% partially adopted it. Notably, none of the rearers used improved mountages for cocooning, and only a minority (18.33%) of the farmers fully adopted the practice of keeping mountages in a semi-dark, well-aerated, and rat-proof room for better cocooning.

Moreover, a majority (100.00% and 70.00%) of the muga rearers fully adopted the practices of selecting well-formed good cocoons for seed production and preservation of seed cocoons at *chokari pera*/wire mesh cages, respectively. However, 30.00% of the rearers only partially adopted the practice of preserving seed cocoons. Similar results also reported that 100 percent of the farmers adopted the practice of preservation of seed cocoon at *chokari pera* in muga culture, [14].

Table 4. Distribution of the rearers on the basis of extent of adoption exhibited to package of practices for rearing muga silkworm. (n=120)

SL. No.	Package of practices for rearing silkworm	Full adoption		Partial adoption		No Adoption	
		Frequency	%	Frequency	%	Frequency	%
1.	Considering of only 1-3 days hatched worms for rearing	32	26.67	42	35.00	46	38.33
2.	Wrapping the tree trunk with oil coated polythene sheet	9	7.50	42	35.00	69	57.50
3.	Brushing of *kharikas* during morning hours of the day	120	100.00	0	0	0	0.00
4.	Brushing of *kharikas* in the right direction	105	87.50	15	12.50	0	0
5.	Brushing of 2-3 dfls per	76	63.33	26	21.67	18	15.00

	plant.						
6.	Transferring only healthy and uniformly moulted worms to new plants	41	34.17	62	51.67	17	14.17
7.	Avoiding frequent handling of worms	120	100.00	0	0	0	0
8.	Avoiding overcrowding of larvae in chaloni as well as in new plants	100	83.33	20	16.67	0	0
9.	Separation of uzi fly infested larvae in different mountages	41	34.17	38	31.67	41	34.17
10.	Use of twigs with semi-dried leaves for cocoon formation	85	70.83	35	29.17	0	0
11.	Use of improved mountage for cocooning	0	0	0	0	120	100.00
12.	Keeping the mountages in semi dark, well aerated and rat proof room for better cocooning	22	18.33	45	37.50	53	44.17
13.	Selection of well-formed good cocoons for seed production as well as for reeling purpose	120	100.00	0	0	0	0
14.	Preservation of seed cocoon at *chokori pera*/ wire mesh cage	84	70.00	36	30.00	0	0

3.5 Extent of adoption of package of practices for disease and pest management of silkworm

It is evident from the Table 5 that 26.67% of the rearers fully adopted the practice of considering only microscopically examined disease-free eggs, while 22.50% partially adopted it and 50.83% did not adopt it. Similarly, regarding the use of nylon nets as a package of practices for rearing silkworms, only 16.67% fully adopted the practice, 10.00% partially adopted it, and the majority (73.33%) did not adopt it at all. In the case of dusting a mixture of slaked lime and bleaching powder in a 9:1 ratio at 200g/m^2 surrounding the base of the plant two days prior to rearing, 48.33% fully adopted the practice, 27.50% partially adopted it, and 24.17% did not adopt it at all. However, no any muga rearer adopted the practice of spraying 0.01% sodium hypochlorite solution on the foliage four days before brushing.

Regarding the disinfection of rearing appliances with a 2% formalin solution, 12.50% fully adopted the practice, 18.33% partially adopted it, and 69.17% did not adopt it. All the rearers fully adopted the practice of collecting and destroying diseased larvae and removing affected twigs/shoots from the field as a part of disease and pest management. Concerning the use of a light trap to attract insect pests, 25.83% fully adopted the practice, 19.17% partially adopted it, and 55.00% did not adopt it.

Additionally, a majority (81.67%) of the rearers did not adopt the practice of using lahdoi to reduce muscardine disease, while 12.50% fully adopted it and 5.83% partially adopted it. Similar study reported that majority of the respondents were not aware about the use of *Lahdoi* to management of muscardine disease of muga silkworm in Assam, [4]. Similarly, regarding the use of smoke to reduce uzi fly infestation, 47.50% fully adopted the practice, 19.17% partially adopted it, and 33.33% did not adopt it for disease and pest management of muga silkworm.

Table 5. Distribution of the rearers on the basis of extent of adoption exhibited to disease and pest management of muga silkworm (n=120)

SL. No.	Disease and Pest Management	Full adoption		Partial adoption		No Adoption	
		Frequency	%	Frequency	%	Frequency	%
1.	Consideration of only microscopically examined disease free eggs	32	26.67	27	22.50	61	50.83
2.	Use of nylon net	20	16.67	12	10.00	88	73.33
3.	Dusting of mixture of slaked lime and bleaching powder in the ratio of 9:1@ 200g/m^2 surrounding the base of the plant 1 week prior to rearing	58	48.33	33	27.50	29	24.17
4.	Spraying of 0.01% sodium hypochlorite solution on the foliage 4 days before brushing	0	0	0	0	120	100.00
5.	Disinfection of the rearing appliances with 2% formalin	15	12.50	22	18.33	83	69.17
6.	Collection and destruction of diseased larvae and removal of affected twigs /shoots from the field	120	100	0	0	0	0
7.	Use of light trap to attract insect pests.	31	25.83	23	19.17	66	55.00
8.	Use of Lahdoi to reduce	15	12.50	7	5.83	98	81.67

	muscardine disease						
9.	Use of smoke to reduce the of uzi fly infestation	57	47.50	23	19.17	40	33.33

3.6 Extent of adoption of package of practices for post cocoon operation of muga silkworm

It is evident from Table 6 that there are notable gaps in the adoption of certain post-cocoon operations among muga rearers. Specifically, only 24.17% of the rearers fully adopted the practice of proper harvesting, sorting, and storing of cocoons, while 55.00% partially adopted it, and 20.83% did not adopt it at all. Moreover, there was no adoption observed for stifling the cocoon in a hot air oven or the use of new technologies and machines for re-reeling and weaving.

A significant majority (80.83%) of the muga rearers did not adopt the practice of reeling muga cocoons in the power cum pedal operated muga reeling machine, while only 19.17% partially adopted it. Similar results also reported that majority of the eri rearers not at all adopted the improves spinning machine to spin eri cocoons in jorhat district of Assam, [13]. .Surprisingly, no any rearer fully adopted this practice for cocoon reeling. Similarly, regarding the use of muga silk plus for cooking the cocoon, the majority (72.50%) of the rearers did not adopt the practice, with only 19.17% partially adopting it and a mere 8.33% fully adopting it.

Table 6. Distribution of the rearers on the basis of extent of adoption exhibited to post cocoon operation of muga silkworm

Sl. No.	Post cocoon operation of muga	Full adoption		Partial adoption		No adoption	
		Frequency	%	Frequency	%	Frequency	%
1.	Proper harvesting, sorting and storing of cocoons	29	24.17	66	55.00	25	20.83
2.	Stifling the cocoons in hot air oven	0	0	0	0	120	100.00
3.	Use of muga silk plus for cooking the cocoon	10	8.33	23	19.17	87	72.50
4.	Reeling of muga cocoon in CSTRI power cum pedal	0	0	23	19.17	97	80.83

	operated muga reeling machine						
5.	Use of new technologies and machines used for re reeling, weaving etc.	0	0	0	0	120	100.00

It is worth noting that despite government subsidies being provided to rearers for the purchase of improved reeling machines, the adoption percentage remains very low for post-cocoon operation practices. These findings suggest a significant gap in the adoption of advanced technologies and modern practices for post-cocoon operations among the muga rearers. Factors contributing to this low adoption may include a lack of awareness, limited access to information and resources, as well as potential challenges related to the affordability and suitability of new technologies. Addressing these barriers through targeted training, extension programs, and enhanced support mechanisms could help to promote the wider adoption of efficient post-cocoon operation practices, ultimately improving the productivity and quality of muga silk production.

Conclusion

The findings suggest that most of the farmers have a moderate level of adoption of scientific muga rearing practices, indicating the need for increased efforts by extension workers to promote improved techniques and boost muga silk production. There's a lack of training exposure among the majority of the rearers, emphasizing the importance of tailored training programs to enhance their skills. There is an opportunity for extension workers to provide ongoing support and foster trust in adopting modern technologies. Identifying barriers to adoption underscores the need for systematic efforts by the authorities to address challenges, enabling farmers to make informed decisions and advance muga culture in the region.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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