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INDIGENOUS TECHNICAL KNOWLEDGE FOR HIGHER FECUNDITY OF MUGA SILKWORM SEEDS

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ABSTRACT

Muga silkworm rearing for production of 'muga silk' is a traditional practice among the rural folk in Assam. The practice involves lots of indigenous technical knowledge (ITK) in its production system. 'Depairing of moths using smoke' is one of the most common ITK used by the muga famers during silkworm seed production. Study conducted to validate efficiency of the ITK, extent of average self de-pairing of moths in four consecutive season of muga silkworm seed production was found higher in ITK (87.0%) as compared to the normal practice (47.0%). Similarly, mean fecundity in four consecutive seasons was counted significantly higher in ITK (168 eggs) as compared to the mean fecundity in normal practice (142 eggs). The study also revealed that extent of hatching of the eggs produced by using the ITK was at par with the egg produced in normal practice. The ITK was also found highly cost effective and the net return of muga silkworm seed production under the ITK was calculated to be increased by 18.0 percent over the normal practice due to enhancement of fecundity. Thus, from the present findings, it could be validated that 'de-pairing of moths using smoke' is highly effective for muga silkworm seed production in terms of fecundity enhancement.

Keywords: Muga culture, indigenous technical knowledge, smoke, depairing of moths, fecundity and hatchability.

Introduction

Indigenous Technical Knowledge (ITK) is an integral part of the cultural practices and everyday life in a particular community based on long experience. India is a highly populated country with large number of indigenous communities, tribes, casts, religions, etc and they have their own set of unique traditional knowledge and culture. Many of these traditional knowledge and practices are at par with the recent innovation and technology system and have been provided the indigenous communities with comfort and self-sufficiency. Muga silkworm (*Antheraea assamensis*, Helfer), a semi domesticated multivoltine insect belongs to order Lepidoptera and family Saturniidae, primarily reared on Som (*Persea bombycina)* and Soalu (*Litsea polyantha*) plants. The silkworm produces unique golden coloured silk called 'Muga Silk' which is more durable and has great valued in the present global market. The silk industry of Assam has flourished and progressed during the Ahom regime (1228-1828) due to the care and keen interest taken by the ruling kings. The Tai-Ahoms had invaded Assam in 1228 A.D. and since then sericulture was an integral part of their culture (Phukan 2012). Muga culture being an age old traditional practices, involves several indigenous practices and beliefs especially in silkworm rearing and seed production over the time. The traditional farmers commonly used the indigenous techniques in selection of healthy brood, silkworm rearing and seed production, pests and diseases management of silkworm, stifling of cocoons, reeling, etc (Bhattacharya *et al.,* 1992; Bhattacharya *et al.,* 1993; Phukan & Chowdhury 2006; Dutta *et al.* 2009; Chakravorty *et al.* 2010; Sarmah *et al.* 2010; Mahan 2012; Chakravorty *et al.* 2015 and Mech *et al.* 2015). Many of the times, these practices have been proved to be effective for higher yield of muga cocoon (Mech & Vijay 2020). Among the large number of indigenous practices followed by the muga rearers throughout the rearing processes, some practices have scientific backgrounds while some of them are found to be superstitious (Unni *et al.* 2009). The muga farmers in Assam strictly followed different traditional practice during silkworm seed production. Among which, one of the most common indigenous technical knowledge is 'de-pairing of moths using smoke' and it is strictly followed by the muga farmers in Upper Brahmaputra Valley of Assam. Muga moths while emerging from cocoon at the evening or late afternoon, the wings appears folded or crinkled. Once the wings are fully dried and expanded they start flapping and mating naturally in the evening itself. The moths which are failed to pair naturally, mechanical attempt is made for pairing in the next day morning to utilize the moths to optimum number for production of eggs. Usually, the muga moths have tendency for pairing more than 20 hours in un-distressed condition. Unless, the moths do not depaired either naturally or mechanically, female moths do not start egg laying. Hence, the paired moths after allowing to pair at least for 4-6 hours need to depair for facilitating egg laying. In this process, paired moths kept in dark room are exposed to light and smoke generate through firing of thatch grass or leaf and twigs of plant at least for a period of 5-10 minutes normally in the afternoon. It has also been reported that after allowing the moths to couple overnight, next morning if the moths are not decoupled naturally, the rearers light a fire at some

distance which helps to decouple of moths (Borthakur 2003 and Thangavelu *et al.* 1988a). The farmers believed that the practice is highly effective for enhancement of fecundity as well as self de-pairing of moths.

However, no report on scientific validation of 'depairing of moths using smoke' was available and hence, attempt was made to test the efficiency of the ITK in muga silkworm seed production in different seasons. The results derived from the study are discussed in the present paper.

Materials and Method

Present study was carried out at the Research Extension Centre, Central Silk Board, Lakhimpur, Assam and performance of muga silkworm seed production using the ITK (treatment) was compared with the normal practice (control) in four consequent grainage seasons. In all the seasons, 100 pairs of naturally paired muga moths each for treatment as well as control were taken for drawing valid inference.

De-pairing of moths: The moths emerged in the evening was allowed to pair naturally in the moth cage itself and the paired moths were picked at the morning hours in the next day. The hind wings of the female moths of each pair of moths were tied at 'kharika' (an egg laying device made up of bunch of thatch grass or twigs of plants) with the help of cotton thread and kept hung systematically in two dark rooms separately for treatment as well as control. The paired moths kept in the treatment room were exposed to light and smoke for a period of 5-7 minutes produced through fire of dry thatch grass at the afternoon in the next day of emergence based on ITK. On the other hand, the paired moths kept in control room were left as such. After 30 minutes of exposing the moths in to light and smoke, extent of self de-pairing of moths was recorded. At the same time extent of self de-pairing of moths kept as control was also recoded. The moths which were still in pairing form were mechanically depaired carefully.

Egg laying: Egg layings of the moths were allowed for three days continuously after depairing in both treatment and control.

Moth examination and harvesting of eggs: Based on the recommended techniques, on the third day of egg laying, mother moths of both the practices were examined individually under microscope to produce disease free layings (DFL).

Fecundity: Fecundity of eggs was counted by taking 50 disease free layings randomly each from treatment and control separately in every season.

Hatchability: In order to examine the hatchability of the eggs, 10 samples each containing of 100 eggs taken from treatment and control was tested separately. The eggs were allowed to hatch for three days and worms hatched everyday in the morning was recorded.

Analysis of data: Data recorded on extent of self de-pairing, mechanical de-pairing, fecundity and hatchability was analyzed statistically using simple frequency, percentage, mean and 'z-test' as applicable.

Result and Discussion

The effectiveness of the ITK was tested in terms of extent of self depairing of moths and fecundity of eggs. Data presented in the Table 1, indicated that extent of average self depairing of moths in four consecutive season of muga silkworm seed production was higher in treatment (87.0%), while extent of average self de-pairing of moths was less in normal practice (47.0%). As a result, mechanical depairing was observed to be very less in treatment (13.0%) as compared to normal practice (53.0%). Similarly, data presented in the Table 2, revealed that mean fecundity in four consecutive seasons was counted as high as 168 eggs under treatment as compared to the mean fecundity of 142 eggs obtained from the moths under normal practice. The 'z-test' of fecundity had shown significant at 1% level of significance which indicates the significant difference between ITK and normal practice (Table 3). Normally, minimum 4-6 hours mating duration is optimum for effective fertilization of all the eggs of the female moth (Thangavelu *et al.,* 1988b and Barah & Sahu, 2003). However, the muga moths have affinity to pair more than 20 hours. Unless de-pairing of moths is not attended, female moths do not start egg laying. In normal practice, depairing of moths is done forcibly through mechanical means using hands by the seed producers. As a result of this practice, genital organ of the female moths become injured and this create a large complication to normal egg laying process of the female moths. Sometimes, due to heavy injury in genital organs of the female moth, egg laying is very poor even ceased completely. Thus, the realized fecundity of eggs produced in normal practice is reduced. In traditional method of seed production, self depairing is performed by exposing the moths to light and smoke generate by fire of thatch grass or dry leaves and twigs of plants for a period of 5-7 minutes based on ITK. Fire of thatch grass in a dark grainage room, generate light and heat as well as smoke. As the light attract the insect, the untied male moths are detached away from the female moths and move toward the light. This may be the probable reason of self deparing while exposing moths to light and smoke. In this method of self de-pairing, injury in genital organs of female moths can be avoided for which moths are able to lay eggs comfortably and realized fecundity is enhanced. Thus, amount of silkworm seed (eggs) produces by using the ITK is possible to increase in to a optimum level which in turn gives higher yield of cocoons to the silkworm rearers.

Table 1: Extent of self de-pairing of moths under treatment and normal practice

Season	Treatment			Normal practice		
	Number of paired moths observed	Self depairing (%)	Mechanical depairing (%)	Number of paired moths observed	Self depairing (%)	Mechanical depairing (%)
December	100	88	12	100	41	59
February	100	84	16	100	40	60
April	100	90	10	100	54	46
October	100	86	14	100	53	47
Average	**100**	**87**	**13**	**100**	**47**	**53**

Table 2: Realized fecundity under treatment and normal practice

Season	Treatment		Normal practice	
	Number of layings	Average fecundity (Nos)	Number of layings	Average fecundity (Nos)
December	50	166	50	141
February	50	172	50	145
April	50	164	50	140
October	50	170	50	143
Average	50	168	50	142

Table 3: Z test on fecundity under treatment and normal practice

Fecundity (ITK Vs Normal)	z-test for Equality of Means					
	Practices	N	Mean	Z	P	z Critical two-tail
December	Treatment	100	166	16.09	0.00**	1.959
	Normal practice	100	141			
February	Treatment	100	172	16.36	0.00**	1.959
	Normal practice	100	145			
April	Treatment	100	164	15.04	0.00**	1.959
	Normal practice	100	140			
October	Treatment	100	170	16.24	0.00**	1.959
	Normal practice	100	143			

** Significant at 1% level

Hatchability

From the data presented in the Table 4, it can be observed that extent of hatching of eggs was at par in treatment (85.0%) with the normal practice (84.9%) of silkworm seed production. Thus it could be depicted that there is no adverse effect on hatchability of the eggs laid by the moths after exposing to smoke.

Table 4: Hatchability of eggs produced under treatment and normal practice

Crops	Hatchability (%)	
	Dfls produced in treatment	Dfls produced in Normal practice
December	90.0	90.0
February	80.0	79.6
April	85.0	85.0
October	85.0	85.0
Average	85.0	84.9

Cost effectiveness

The ITK was also validated in terms of cost effectiveness. Examining the cost effectiveness of the ITK (deparing of moths using smoke), revealed that no supplementary cost was involved in muga silkworm seed production process using the ITK. The practice rather, enhanced the return of silkworm seed production by 18.0 percent due to enhancement of fecundity of eggs over the normal practice. The extra time and manual labor required for the process of smoking at ITK was found to be completely reciprocal with time and manual labor required for mechanical de-pairing of moth.

Conclusion

From the present study, it could be inferred that the ITK 'self depairing of moths using smoke' is effective for enhancing fecundity of muga silkworm eggs. It was also established that while using the ITK, no supplementary cost is involved, rather enhanced return to a considerable extent due to enhancement of fecundity. Most importantly, there is no adverse effect on hatchability of eggs produced by using the ITK. Since the ITK is very much cheaper, materials used are locally and easily available, the use of the ITKs may be encouraged for enhancing fecundity as well as higher ratio of dfl and cocoon yield at the concerned field.

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