EARLY STAGE INDOOR TRAY REARING OF MUGA SILKWORM (*ANTHERAEA ASSAMENSIS* HELFER*)* – A COMPARATIVE STUDY IN RESPECT OF LARVAL CHARACTERS

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ABSTRACT: Hatched larvae from 25 dfls of Muga silkworm were simultaneously reared indoor on wooden tray device up to 2nd instar and outdoor providing Som and Soalu leafs as feed throughout one year representing all rearing seasons. Larval weight, larval duration and larval survival were studied in respect of indoor and outdoor rearing on Som-Soalu host plants. Hatched out larvae differ in weight according to seasons highest observed 0.007g per larva during Sept.-Oct. rearing season and lowest being 0.005g per larva during March-April and Nov.-Dec. The larval weight of different instars does not depend upon initial larval weight and size and weight of eggs, depend upon environmental temperature. Larval weight, larval duration and larval survival were found different from each other in Som and Soalu leafs from their indoor and outdoor counterparts. Indoor rearing on detached twigs in wooden tray does not vary mark ably from outdoor rearing on trees. Climatic conditions are the most important factors to be considered in Muga silkworm cultivation regardless of indoor or outdoor rearing.

KEY WORDS: Indoor, Outdoor, Rearing, Som, Soalu, Wooden tray, Larvae, Instars, dfls.

Muga silkworm culture is a traditional outdoor rearing practice adopted by people of North Eastern States mainly Assam. Muga silkworm *Antheraea assamensis* Helfer belongs to Lapidoptera of Saturniidae family and, geographically isolated only to NE region of India. Geographical isolation of this silkworm is indicative of its special requirements for geo-climatic conditions that prevail in this region i.e. high humid temperate climate and forest vegetation of primary and secondary host plants. Thus this species is phylogenetically less adaptive reaching its ecological isolation that is indicative of being on verse of extinction. Although Muga silkworm since time immemorable has been reared for Muga silk still it is purely an outdoor culture in host plant under natural conditions. Only cultural specificity is being managed and took care by Muga rearer. Being exposed to natural environment Muga culture practice encounter lots of problems right from brushing of worms to spinning of cocoons. Outdoor silkworm larvae are invariably expose to nature's vagaries such as seasonal climate change, rainfall, strong wind, soaring temperature, besides pests, predators and pathogens inflecting heavy loss particularly in early three instars. Prophylactic measures adopted for pest and disease in outdoor rearing became fruitless due to cross infestation by both pests and pathogens are common in open conditions. In an average in all seasons more than 50% larval loss has been reported by many scientists. Sengupta et al. (1992) reported that during summer more than 50% loss was due to abiotic factors and 80% of the total loss of muga silkworm occurred in second/third instar only. Several workers experimentally practiced indoor rearing of muga silkworm applying different types of rearing devices and, some of them reported effective over outdoor rearing. Singh & Barah

(1994) conducted partial indoor rearing up to third stages with Som and Soalu twigs in bottle, iron tray and wooden and, reported larval mortality could be reduced marginally as compared to outdoor rearing. Cellular rearing technique developed by Thangavelu & Sahu (1986) for indoor rearing of muga silkworm was found suitable during different seasons for improvement in ERR on Soalu plant, but female cocoon weight and fecundity were found significantly higher on 'Som' plant. Similarly Bhuyan et al. (1991) reported that indoor rearing in iron tray (3" x 4" x 4") with water and sand bed covered with slotted cover containing 'Som' twigs showed better ERR (58.8%) as compared to control (51.3%). So, keeping in view of the present constrains faced by muga silkworm cultivation in outdoor conditions, the present comparative studies were undertaken to evaluate wooden tray device in indoor rearing practice of *A. assamensis* Helfer.

MATERIAL AND METHODS

For the experiments wooden trays of 5" X 2" X 3" with wire mesh (2mm X 2mm size) at either sides with top covering of white cloth fitted with the tray, were taken as indoor rearing device. One Som plant and one Soalu plant of 7-8 years old with plastic net covers were selected from the outdoor garden at a site of complete sunlight for outdoor control rearing. At the same site another host plant stock of same age group were selected to supply leafs for indoor rearing as treatment. Prior to experiments prophylactic measures of disinfestations were given to both outdoor plants and indoor devices.

Twenty five numbers dfls of *Antheraea assamensis* Helfer were taken from Silkworm Seed Technology Section of the institute. Eggs were kept in perforated brown paper envelop and incubated in B. O. D. incubator at 25°± 1°C. After 6 days of incubation eggs were placed in paper made black box and further incubated for one more day at same temperature. Next the eggs were taken on paper tray and exposed to sunlight. Within two hours the young larvae hatched out prominently making sound. Initial weight of emerged larvae at random was taken by electronic balance. The worms were brushed indoor on detached fresh twigs of Som and Soalu (300 nos. per tray) kept in wooden trays (T). Simultaneously same number of worms was brushed outdoor pre-selected Som and Soalu plants unde3r net cover as control (C). In wooden tray device, perforated polythene sheets and wet foam-pads were used to keep the leaves fresh for longer time. Rearing beds were cleaned once and fresh leafs were given twice a day in the morning and evening hours. During moult, top polythene cover and wet foam pads were removed to keep the bed dry. Just after moult, larval weights were measured and recorded in each instars. Larval duration is counted as number of days required in each instar. After end of each instar, larval survivability was recorded as percentage of living worm. Data of larval weight, larval duration and larval survival of both the treatment and control were recorded in tabulated form and statistically analyzed. The experiments were conducted during five different seasons in one year.

In reaching third instar, all larvae of treatment then transferred and brushed separately on individual pre-selected Som and Soalu trees under net cover in same outdoor garden plot that continued till harvesting.

RESULTS AND DISCUSSION

Results of the experimental data are presented in table-1 and 2. The rearing experiments were carried in different seasons through out the year, e.g. March-April; May-June; July-August; September- October and November-December.

The data in the tables reveals distinct variations in larval weight, larval duration and larval survival in different rearing seasons irrespective of indoor (T) and outdoor (C) rearing. Interestingly, newly hatching out larvae also markedly differs in weight according to season. The heaviest hatching out larvae were found in rearing season of September-October, the weight being recorded at 0.007g and, average lowest weight i.e. 0.005g recorded in rearing seasons March-April and November-December. In the experiment, after first instar highest larval weight in indoor rearing (T) was recorded during March-April in both the cases of Som and Soalu i.e. 0.028 g and 0.033 g respectively. In case of outdoor rearing (C) highest larval weight after first instar was recorded in July-August (0.029g) in Som and, March-April (0.032g) in Soalu. Again, the larval weight after second instar was found highest in July-August in both Som and Soalu leaf feeding tray rearing, being 0.147 g and 0.134 g respectively. Whereas in control (C) after second instar, the same was found 0.173g in Som and 0.170g in Soalu during July-August only. During March-April indoor reared larvae showed enhanced weight over control in both Som and Soalu leafs and also required shorter larval duration than their outdoor counterparts. But their survival in indoor rearing condition is lower than outdoor control. In rearing season May-June, first instar larvae of indoor tray does not exhibit any difference in their weight and duration over outdoor rearing, but lower larval survival was recorded in Soalu. At the end of second instar, larval survival was found slightly lower in both Som and Soalu over control, whereas larval weight was higher in Som and lower in Soalu than their outdoor counterparts. In rearing season July-August larval weight in 1st and 2nd instar were lower in both Som and Soalu than their respective outdoor rearing. In case of larval survival in first instar also except Soalu, lower values were recorded over the control. Larval duration was recorded more or less same in all the cases. No significant difference was observed in larval weight and duration in the 1st instars during rearing period Sept.-Oct. But larval survival was higher in Som over control and lower in Soalu over control. At second instars stage, differences were recorded in all cases except larval duration. Indoor reared larvae exhibited lower value than outdoor except that larval survival was higher i.e. e. 68.0% in Som. During Nov.-Dec, irregular values in respect of larval weight, larval duration in Som and Soalu were recorded. However, higher survival of both first and second instars larvae was recorded over control counterparts of Som and Soalu. During this season, larval survival was all time higher being 97.0% in Som and 92.7% in Soalu at 1st instars and, 89.0% in Som and 84.0% in Soalu at 2nd instars. Data in both the table-1 and table-2 reveals differences in all cases according to food plants (Som & Soalu) of these two rearing conditions.

Thus, it is found from above discussion that indoor rearing of Muga silkworm on detached twigs of Som and Soalu in wooden tray does not differ significantly from outdoor rearing in trees. The former type of rearing prominently exhibited seasonal variations like outdoor rearing. Both the outdoor (C) and indoor (T) rearing were subjected to seasonal climatic changes that mainly included temperature, humidity, leaf moisture, nutritional status of food pant leaves, disease-pest incidence as influencing factors. Das et al. (2004) reported that being multivoltine in nature; *Antheraea assamensis* Helfer experiences a wide range of temperature (12-37° C) and relative humidity (59-92%) during different climatic seasons of the year. Therefore, it can be inferred that climatic factors are the most influencing factors to be considered in Muga silkworm cultivation regardless of indoor or outdoor rearing. Although there is no significant difference in rearing performances, during unfavorable seasons like very hot climate, very cool and dry climate, indoor rearing may be adopted for Muga silkworm cultivation only by

developing effectively indoor rearing environment for optimum growth and development. Raja Ram and Sinha (2004) reported that indoor rearing of Muga silkworm on Soalu branches inside perforated polythene bag gave highest ERR during July-August (70.0%) followed by Sept.-Oct. (23.05%) and May-June (15.5%). Talukdar (1999) stated that maintenance of optimum temperature and relative humidity together with disinfestations of rearing room are pre-requisite for good crop harvest.

Further, embryonic tissue growth also differs according to seasonal changes of climate as indicated by variation in weight of newly hatched out larvae in different crop seasons. Hazarika et al. (2004) reported that the size of the egg determines the size and weight of first instar larvae. According to Das et al. (2004) superior egg having 0.0078g weight with 2.8 mm diameter are laid during June and, worst one of 0.0069 weight having 2.0 mm diameter are laid during February. Thus low temperature condition prevailing during November-December and March-April produced hatched larvae of low weight and, high temperature during May to September produced hatched larvae of higher weight as found in our experiment (Table 1).

Since, heaviest larvae were recorded in March-April in first instar and, July-August in second instars in contrast to heaviest newly hatched out larvae during Sept.-Oct., it can be inferred that the larval weight in subsequent instar does not depend upon initial larval weight and hence the size and weight of eggs. Further, as the nutrient compositions in these two host plants differ, it can be very clearly presume the nutrition as the determining factor on larval weight, larval duration and larval survival. Several workers has been worked on indoor rearing of muga silkworm on Som and Soalu host plant and, reported different results, but all found different values in respect of larval weight, larval duration and larval survival in these two host plants. According to Thangavelu et al. (1983) cocoon weight, shell weight, filament length, reel ability and fecundity were higher on Som than Soalu under indoor rearing conditions. Hazarika et al (2004) on the other hand recorded longer larval period and lower cocoon weight but higher shell ratio in indoor wooden box rearing of muga silkworm on Som than outdoor rearing.

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Table 1. First instars Larval Weight (LW), Larval Duration (LD) and Larval Survival (LS) of indoor (T) and outdoor (C) rearing of Muga silkworm in different seasons of a year.

Sl. No.	Period of rearing	Rearing types	Weight of single larva (in gram) of first instars						Larval duration (days)		Larval survival (%)	
			SOM			SOALU			SOM	SOALU	SOM	SOALU
			Initial	Final	Tissue growth	Initial	Final	Tissue growth				
1	March-April	T	0.005	0.028	0.023	0.005	0.033	0.028	5-7	4-6	84.3	79.7
		C	0.005	0.028	0.023	0.005	0.032	0.027	5-8	4-7	89.3	88.7
2	May-June	T	0.006	0.025	0.019	0.006	0.024	0.018	4-6	4-6	85.3	88.3
		C	0.006	0.025	0.019	0.006	0.024	0.018	4-6	4-6	87.3	82.0
3	July-Aug.	T	0.006	0.028	0.022	0.006	0.027	0.021	3-5	3-5	79.0	87.5
		C	0.006	0.029	0.023	0.006	0.030	0.024	3-5	3-5	79.5	78.0
4	Sept.-Oct.	T	0.007	0.025	0.018	0.007	0.029	0.022	3-4	3-4	79.0	71.0
		C	0.007	0.025	0.018	0.007	0.030	0.023	3-4	3-4	77.0	78.0
5	Nov.-Dec.	T	0.005	0.025	0.020	0.005	0.023	0.018	5-7	5-7	97.0	92.7
		C	0.005	0.024	0.019	0.005	0.025	0.020	6-9	6-8	88.3	90.3
AVERAGE			**0.0058**	**0.0262**	**0.0204**	**0.0058**	0.0277	**0.0219**			**84.6**	**83.62**

Table 2. Second instars Larval Weight (LW), Larval Duration (LD) and Larval Survival (LS) of indoor (T) and outdoor (C) rearing of Muga silkworm in different seasons of a year.

Sl. No.	Period of rearing	Rearing types	Weight of single larva (in gram) of second instars						Larval duration (days)		Larval survival (%)	
			SOM			SOALU			SOM	SOALU	SOM	SOALU
			Initial	Final	Tissue growth	Initial	Final	Tissue growth				
1	March-April	T	0.028	0.098	0.070	0.033	0.107	0.074	5-7	4-6	84.3	79.7
		C	0.028	0.095	0.067	0.032	0.104	0.072	5-8	4-7	89.3	88.7
2	May-June	T	0.025	0.088	0.063	0.024	0.075	0.051	3-6	3-6	58.3	47.0
		C	0.025	0.083	0.058	0.024	0.077	0.053	3-6	3-6	58.7	51.7
3	July-Aug.	T	0.028	0.147	0.119	0.027	0.134	0.107	4-6	4-6	73.0	79.5
		C	0.029	0.173	0.144	0.030	0.170	0.140	4-6	4-6	73.0	68.5
4	Sept.-Oct.	T	0.025	0.107	0.082	0.029	0.128	0.099	3-5	3-5	68.0	62.0
		C	0.025	0.132	0.107	0.030	0.139	0.109	3-5	3-5	63.0	67.0
5	Nov.-Dec.	T	0.025	0.126	0.101	0.023	0.093	0.070	3-6	3-8	89.0	84.0
		C	0.024	0.123	0.099	0.025	0.120	0.095	4-8	5-7	78.0	79.7
AVERAGE			**0.0262**	**0.1172**	**0.091**	**0.0277**	**0.1147**	**0.087**			**73.46**	**69.789**

PICTURE -1: Wooden tray device for indoor rearing if Muga silkworm

PICTURE -2: Second instar Muga silkworm larvae reared on Soalu leafs in wooden tray

PICTURE -3: Cocooning by ripen indoor larvae

PICTURE -4: Harvested cocoon from outdoor

PICTURE -5: Harvested cocoon from indoor wooden tray rearing.

PICTURE -6: A Muga mother moth laying eggs

PICTURE -7: Eggs of Muga silkworm