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Effect of Season on Reproductive Parameters of Muga Silkworm (*Antheraea assamensis* Helfer)

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ABSTRACT

The study was undertaken at the Department of Sericulture, Assam Agricultural University, Jorhat (Assam) to find out the impact of season on reproductive parameters of muga silkworm, *Antheraea assamensis* Helfer in autumn and spring season. The study revealed that though the fecundity was registered better in autumn; hatching percentage of egg (seed) of the muga silk moth performed better in spring season. Although season had significant effect on weight of eggs but non significant effect was observed on oviposition period and hatching period of muga silk moth eggs.

Key words: *Autumn, Fecundity, Hatching percentage, Mating duration, Muga silkworm, Spring*

Introduction

Muga silkworm, *Antheraea assamensis* Helfer, a semi domesticated species belonging to saturniidae family is indigenous to north–eastern region of India *viz*., Assam and its neighbouring states of Meghalaya, Arunachal Pradesh, Nagaland, and Mizoram. Among these states, muga silk production is confined mainly to the state of Assam. Assam is the only state which is engaged in the production of reeling cocoons, while the other states have the privilege of producing major quantity of seed cocoons for commercial multiplication. Muga silk is not only famous for its unique golden colour but is also considered as the pride of Assam. The elegant aesthetic appeal of the natural silk is probably unparalleled in the history of textiles.

Most of the species of *Antheraea* are polyphagous and it is one of the largest genera in the saturniidae family where most species produce valuable silk, which has not yet been domesticated for commercial exploitation. Muga silkworm is multivoltine and consists of 5-6 crops in a year out of which two are commercial crops *viz*., *Jethua* (spring) and *Katia* (autumn). The key factor of sericulture industry is seed and availability of good quality silkworm seed is vital for viable sericulture industry. Good quality of seed refers to richness of egg laying, viability, uniform hatching and subsequently good rearing performance of the progeny (Ullal and Narashimhanna, 1981). Several factors contribute to production of good quality eggs. The biotic and abiotic factors of the environment during different seasons highly influence the life cycle features of the *Antheraea mylitta*

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in the form of cocoon weight, larval weight, pupal weight, shell percent, shell weight, percent emergence, percent coupling, percent hatching, adult longevity, fecundity, and reelability of the silk (Jolly *et al*., 1974; Thangavelu and Sahu, 1986; Nayak and Dash, 1974; Chaoba Singh *et al*., 1991; Yadav *et al*., 1992; Nayak *et al*., 1993; Zhu *et al*., 2000; Chen *et al*., 2002; Seema *et al*., 2004). The change of climatic factors especially relative humidity and temperature is known to affect all the stages of a silkworm's lifecycle including their development and survival. Through several researches it has been found that the optimum temperature for muga silkworm rearing is 20-31 °C and 65 to 95% of relative humidity (Tikader *et al*., 2013). It has been reported by Krishnaswami *et al*., 1971, that October to March when both the average temperature and relative humidity are comparatively lower, silkworm cocoon crop grow richer and the season is called favourable.

Since production and supply of quality seed in desired quantity is one of the challenging tasks of muga industry, a methodological and systematic approach of muga seed production is a need of the hour to overcome the problem of quality seed production in time. Good hatching percentage will not only increase the production and productivity of muga silk but will also increase the returns and will give an economic boost to the rearers. Keeping all these in view this experiment has been conducted to find out the effect of season on reproductive parameters of muga silkworm.

Materials and Method

The investigation was conducted in the year 2016-2017 in the Department of Sericulture, Assam Agricultural University, Jorhat. Fresh quality muga seed cocoons harvested from two important seed crops *viz*., '*Jarua*' (Dec-Feb) and '*Bhodia*' (August-Sept) were collected from the private muga seed growers of North lakhimpur and Dhemaji district of Assam to conduct the investigation and to produce seed for two rearing seasons *viz*., spring (March-April) and autumn (Nov-Dec). Collected seed cocoons of muga silkworm were preserved in well ventilated wire mesh cocoon storage cages at normal room temperature till the moth emergence (Plate 1) following the method of Thangavelu *et al*. (1986). The freshly emerged male and female moths (Plate 2) were allowed to couple naturally in the cocoon preservation cages. The coupled moths were tied to oviposition device (*kharika*-made from thatch grass) by binding the female moth with the help of cotton thread. The moths were allowed to couple for 2hrs, 3hrs, 4hrs and 5hrs. The female moth along with the oviposition device were kept in the semi dark condition and allowed to lay eggs (Plate 3) following the method

Plate 1. Moth emergence from muga seed cocoon

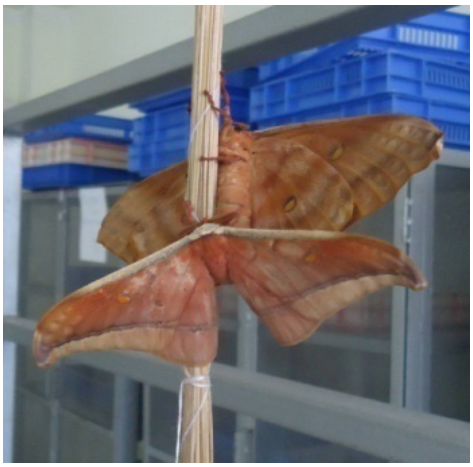

Plate 2. Coupling of muga moths

Plate 3. Oviposition of muga moth

suggested by Chowdhury (1981). The different parameters *viz*., oviposition period, fecundity, weight of eggs, incubation period, hatching period and hatching percentage were recorded to find out the suitable season between the spring and autumn season.

Results and Discussion

The data on oviposition period (Table 1) of muga silk moth due to effect of season was not significant. However, longer oviposition period (6.33 days) was noticed in 5 hrs mating duration during spring season.

Table 1. Effect of season on ovposition period (days) of muga silk moth in different mating durations

Mating duration (Hours)	Season	
	Spring	Autumn
2Hrs	5.91	6.08
3Hrs	6.08	5.75
4Hrs	5.83	6.16
5Hrs	6.33	5.66
Mean	6.04	5.91
	S.Ed	CD (5%)
Season	NS	NS
Season x Mating duration	NS	NS

Data are mean of 3 replications
NS= Non-significant

Muga silk moth laid (Table 2) significantly more number of eggs in autumn season (191.83 eggs/laying) than in spring season (157.54 eggs/laying). The interaction effect due to season and mating duration was significant. Regardless of season and mating duration the highest number of eggs (223.67 eggs/laying) was laid during autumn season at 4 hrs mating duration and the lowest (126.17 eggs/laying) during spring season at 2 hrs mating duration.

Table 2. Effect of season on number of eggs (eggs/laying) laid by muga silk moth in different mating durations

Mating duration (Hours)	Season	
	Spring	Autumn
2Hrs	126.17	175.25
3Hrs	156.00	156.17
4Hrs	164.67	223.67
5Hrs	183.33	212.25
Mean	**157.54**	**191.83**
	S.Ed	CD(5%)
Season	5.94	11.87
Season x Mating duration	11.88	23.73

Data depicted in Table 3 revealed that weight of eggs laid by muga silkworm was registered significantly more in autumn season (1.20g/laying) than in spring season (1.04g/laying). The interaction effect due to season x mating duration was also significant. The highest weight of egg (1.36g/laying) was recorded at 5 hours mating duration in autumn season while it was recorded lowest (0.80g/laying) at 2 hours mating duration in spring season.

Table 3. Effect of season on egg weight (g/laying) of muga silkworm in different mating durations

Mating duration (Hours)	Season	
	Spring	Autumn
2Hrs	0.80	1.13
3Hrs	1.03	0.98
4Hrs	1.13	1.34
5Hrs	1.19	1.36
Mean	**1.04**	**1.20**
	S.Ed	CD (5%)
Season	0.04	0.09
Season x Mating duration	0.09	0.17

Data are mean of 3 replications

The incubation period (Table 4) was recorded significantly longer (11.98 days) in autumn than in spring season (10.00 days). The interaction effect due to season x mating duration was not significant. Regardless of the season and mating duration, incubation period was recorded longest, i.e. 12.17 days in 3 hrs mating duration during autumn season and shortest (9.67 days) in 4 hrs mating duration during spring season.

Table 4. Effect of season on incubation period (days) of muga silkworm eggs in different mating durations

Mating duration (Hours)	Season	
	Spring	Autumn
2Hrs	10.25	12.08
3Hrs	10.00	12.17
4Hrs	9.67	11.97
5Hrs	10.08	11.75
Mean	**10.00**	**11.98**
	S.Ed	CD (5%)
Season	0.11	0.23
Season x Mating duration	NS	NS

Data represented are mean of 3 replications
NS=Non-significant

Results (Table 5) revealed that season and interactions due to season and duration of mating had no significant effect on hatching period of muga silk moth eggs. The egg hatching period was continued for 5.87 days in spring and 5.75 days in autumn season.

Table 5. Effect of season on period of egg hatching (days) of muga silkworm in different mating durations

Mating duration (Hours)	Season	
	Spring	Autumn
2Hrs	5.83	6.08
3Hrs	6.00	5.33
4Hrs	5.83	6.08
5Hrs	5.83	5.50
Mean	5.87	5.75
	S.Ed	CD (5%)
Season	NS	NS
Season x Mating duration	NS	NS

Data are mean of 3 replications
NS=Non-significant

It has been observed from Table 6 that season and interaction between season and mating duration had significant effect on hatching percentage of eggs of muga silk moth. The hatching percentage of muga eggs were recorded significantly highest (92.46%) in spring than in autumn (91.93%) season. The interaction effect due to season x mating duration was found to be significant. Regardless of season and mating duration hatching percentage was observed to be the highest (95.33%) in 3 hrs mating duration during spring season.

Table 6. Effect of season on hatching percentage of muga silk moth egg in different mating durations

Mating duration (Hours)	Season	
	Spring	Autumn
2Hrs	91.30	89.34
3Hrs	95.33	92.78
4Hrs	93.21	93.84
5Hrs	89.97	91.75
Mean	**92.46**	**91.93**
	S.Ed	CD (5%)
Season	0.34	0.68
Season x Mating duration	0.68	1.36

Data represented are mean of 3 replications

Discussion

The biology and development of insect is highly influenced by seasonal variation (Odum, 1983; Ouedraogo *et al*., 1996). Muga silkworm is also not the exception of it in which seed production is the most critical sector that drives the entire silk value chain. Thangavelu *et al*. (1988) reported that egg laying of muga silk moth continues for 5-6 days and the numbers of egg laid on different days varies considerably. Srivastava *et al*. (1998) reported that environmental conditions are the main cause of variability in *A. mylitta* because the fecundity, hatchability and economic characters of cocoon and silk. Kakati *et al*. (2005) reported higher fecundity of muga silk moth during autumn season but hatching percentage of muga silk moth eggs was more in spring season. Fecundity of eri silkworm has been also registered higher in autumn season than in spring season (Sarkar and Sarmah, 2010). Sharma and Kalita (2017) reported that out of six strains of eri silkworm four nos. (*viz*., Greenish blue plain, Greenish blue spotted, Greenish blue zebra and Yellow Zebra) of strain had shown higher fecundity in autumn season than that of spring season. Deka *et al*. (2011) found better performance of Daba ecorace (TV) of *A. mylitta* in spring season and followed by autumn, winter, and summer seasons. Rangaswami *et al*. (1976) reported that hatching period of muga silk moth eggs require 7-8 days in summer and 14-15 days in winter season.

Conclusion

Season had significant effect on fecundity, incubation period and hatching percentage of eggs. In the investigation, it has been found that the fecundity of muga silk moth was better in autumn season (Nov-Dec) with shorter incubation period than that of spring season (March-April) whereas, hatching percentage of muga silkmoth eggs performed better in spring season (March-April) than that of autumn season (Nov-Dec).

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Conflict of interest

There is no conflict of interest among the authors.

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