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Comparative study on the Rearing performance of muga silkworm (*Antheraea assamensis* Helfer) on two primary host plants Som (*Persea bombycina* Kost) and Soalu (*Litsea monopetala* Roxb) in different rearing seasons

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ABSTRACT

Muga, *(Antherea assamensis*, Helfer) is a polyphagous multivoltine insect. (Chakravorty *et al*., 2004) Due to outdoor rearing the muga larvae are subject to different biotic factors and abiotic stress. The seasonal differences in the environmental components considerably affect the genotypic expression in the form phenotypic output of silkworm such as cocoon weight, pupal weight, shell weight and shell ratio. An attempt has been made on two primary host plants viz. Som and Soalu to investigate their comparative performance on rearing in study area on different rearing seasons. Results indicated highest Shell weight and Shell Ratio(SR %) when fed on Som plant (T1) where as Larval weight, Pupal weight is highest when fed on Soalu (T2) plant and the results also reveals lowest performance in Soalu to Som fed batch (T3). This study also reveals that Kotia (V1) season showing best rearing performance followed by Jethua (V2), Bhodia (V3) and Chotua (V4). This study was conducted continually three years in the same area and showing same trend. T-1 and V1 showed the best commercial characters of Antherea assamensis, Helfer when silkworm larvae were feed with Som leaves. Therefore, it is suggested that Som leaves can be used in rearing for higher yield of muga silk. If there is a shortage of Som leaves during commercial rearing, then Chawki rearing can be done in Soalu plants and then transferred to Som plant for late age rearing.

Key words : *Som, Soalu, Kotia, Shell Ratio %,* Antherea assamensis*, Helfer, Comercial Rearing*

Introduction

Muga silkworm reared for two main purposes, for silkworm seed production and secondly for production of reeling cocoons. Muga silkworm rearing conducted by farmers of Meghalaya state mainly utilized for seed production whereas Goalpara, Kamrup, Sivasagar and foot hills of Meghalaya conduct muga silkworm rearing for seed purpose. Rest of Assam viz, Lakhimpur, Jorhat, Dibrugarh, Bangaigaon, Borpeta, Sonitpur, Darrang, BTAD areas etc., conduct commercial rearing for production of reeling cocoons. About 60% of total Muga and Eri produced by Farmers and remaining 40% by Govt sector (Choudhury, 1992). Ministry of Textiles, Govt. of India through Central Silk Board has invested

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sufficient fund for infrastructure development, manpower and Research and Development support to the North eastern States by implementing various schemes viz., Catalytic development Project (CDP), North Eastern Regional Technology Promotion scheme (NERTPS), Samarth, etc for up liftment of sericulture mainly Muga and Eri. Assam is the abode of muga silkworm (CSB, Annual Report, 2017-2018)

The golden yellow muga silk of Assam is the sole product of India and nowhere in the world is available due to peculiar insect behavioural adaptation and requisite climatic condition (Ahmed and Rajan, 2010). Muga culture has been practised by about 44,000 families in the different states of North Eastern region out of which Brahmaputra valley of Assam is the main production zone and contributes to about 83.74% of India's total muga silk production. Muga production in Assam is mainly concentrated in the districts of Tinsukia, Dibrugarh, Sivasagar, Jorhat, Golaghat, Lakhimpur, Dhemaji, Kokrajhar, Udalguri, Goalpara and Kamrup. Assam is mainly known for commercial rearing where Meghalaya is known for seed rearing.

Anthereae assamensis Helfer is polyphagus multivoltine in nature and has manifold host plants. (Chakravorty *et al*., 2004). The primary host plant of *Antheraea* assamensis Helfer is Som (*Persea bombycina* Kost), which belongs to the family Lauraceae. Som plantation is abundant in the plains and hills of the North Eastern Region. Since time immemorial Muga silkworm has been reared outdoor in host plant under natural conditions (Semidomesticated). Muga silkworm has six broods in a year. The different broods are Chotua/Late Winter (February-March), Jethua/Spring (April-May), Aherua/Rainy (June-July), Bhodia/Summer (August-September), Kotia/Autumn (October-November) and Aghenua/Winter (November- January). Out of these, only two broods *viz.* Jethua/Spring and Kotia/Autumn are commercial crops. The other broods are raised as seed and pre-seed crops. Outdoor rearing encompasses harsh climatic conditions, pest and predators, host plant quality, natural factors like hailstones, wind etc influencing the rearing. (Singh *et al.,* 2004)

The accomplishment of a successful Sericulture crop is primarily dependent on leaf quality and favourable environmental conditions for silkworm. Leaf constituents are the sole source of nourishment as the plant protein consumed gets transformed into silk protein. These perennial host plants are abundantly available in North Eastern region. Outdoor rearing encompasses varied factors for a successful crop Rearing of Muga silkworms is done in outdoor allowing them to feed on leaves of standing host plants till they mature and collected to form cocoons inside cocooning halls. Thus the silkworm populations remain under the influence of climatic or weather conditions. The survivability of worms, as well as harvesting of ripened worms, depends on several factors, out of which host plant has the major role. According to Choudhury, (1992) relative contribution of such factors responsible for a successful crop harvest has been estimated as: Host plant (38.2%), climate (37.0%), rearing technique (9.3%), silkworm race (4.2%), silkworm egg (3.1%) and other factors (8.2%).

The nutritive value of host plants and their seasonal variability are closely related to that of the silk worm (Yokoyama, 1963). The growth and development of muga silkworms are prejudiced to an immense extent by the nutritional content of the leaf. Because, host plants acts as a foremost part for successful crop, it is vital to assess the preeminent host plant subsequently to proliferate the top one for commercial exploitation (Reddy *el al.,* 1989; and Maribashetty *et al*., 1999). In the present study, an attempt to compare the rearing performance of Muga silkworm on two different host plants in different seasons.

Materials and Methods

The growth and development of muga silkworm on two host plants Som and Soalu

40 nos each of *Persea bombycina* Koast and *Litsea monopetala* Roxb of same age (10 years) seleced for the study. Treatments were taken from two commercial crop-Jethua (April-May) and Kotia (October-November) and two seed crop - Bhodia (August-September) and Chotua (February-March). Disease free layings (DFLs)of *Antherea assamensis* Helfer obtained separately for conducting rearing. Plantation maintained as per packages of practices.

1000 worms of *Antherea asamensis* Helfer brushed in tender leaves of *Persea bombycina* Kost as control (T1) and continued up to maturation. 1000 worms of *Antherea asamensis* Helfer bushed in tender leaves of *Litsea monopetala Roax* as control(T2) continued up to maturation. 300 worms of 3rd instar worms fed on

Persea bombycina Kost transfered to *Litsea monopetala* Roxb and fed up to maturation as treatment (T3). 300 worms of 3rd instar worms fed on *Litsea monopetala* Roxb transfered to *Persea bombycina* Kost and fed up to maturation as treatment (T4). Each treatment conducted in 3 replication. Economic traits of *Antherea assamensis* Helfer viz, larval duration, larval weight, ERR%, cocoon weight, shell weight and silk ratio were studied. The experiment was conducted in three years during 2016 to 2018 and data were collected.

Rearing Season

- Kotia (V1) (October-November)
- Jethua (V2) (April-May)
- Bhodia (V3) (August-September)
- Chotua (V4) (February-March)

Host Plants

- *Persea bombycina* Kost (1st to 5th)/ Control (T1)
- *Litsea monopetala Roax* (1st to 5th)/ Control (T2)
- *Persea bombycina* Kost (1st to 3rd) + *Litsea monopetala* Roxb (4th to 5th)/Treatment (T3)
- *Litsea monopetala Roax* (1st to 3rd) + *Persea bombycina* Kost (4th to 5th)/ Treatment (T4)

Location

The experiment was conducted in the P2 farm, Dhupguri, Boko, kamrup, Assam. Leaf samples of Som and Soalu has been collected in Four rearing season viz. two commercial crop-Jethua (April-May) and Kotia (October-November) and two seed crop - Bhodia (August-September) and Chotua (February-March) during 2016 as tender, semimature and mature leaves. Samples collected sent to Central Muga Eri Research and Training Institute, Lahdoigarh, Jorhat, Assam for analysis. Data collected were statistically analyzed by Factorial RBD Design.

Results and Discussion

The data pertaining to cocoon weight (g) are presented in Table 1. Cocoon weight of Muga Silkworm as influenced by different rearing crops and host plants was observed to be affected significantly during study.

Among the rearing crop, Kotia (Oct-Nov) has resulted in significantly higher cocoon weight as compared to the rest of the treatment. Coccon weight in Jethua crop (April – May) recorded significantly lower to Kotia crop and higher as compared to Bhodia crop (Aug – Sept). However, Chotua crop (Feb – March) recorded significantly lowest cocoon weight in the investigation.

The data further revealed that host plant had significant effect on cocoon weight. *Litsea monopetala* Roxb (1st to 5th) recorded significantly highest cocoon weight as compared to remaining host plant during the experiment. *Persea bombycina* Kost(1st to 3rd) + *Litsea monopetala* Roxb(4th to 5th) recorded second highest cocoon weight which was significantly superior from treatment T_1 and T_4.

The data pertaining to shell weight (g) are presented in Table 2. Shell weight as influenced by different rearing crops and host plants was observed to be affected significantly during study.

Among the rearing seasons, Kotia has resulted in significantly higher shell weight as compared to shell weight under Bhodia and Chotua. However, Jethua crop was equally effective as the Kotia crop.

Table 1. Effects of different rearing season and host plant on cocoon weight (g) of Muga silkworms.

Treatments	Cocoon Weight (g)		
	2016	2017	2018
Kotia (Oct – Nov)	4.96	5.01	4.97
Jethua (April – May)	4.95	4.96	4.88
Bhodia (Aug – Sept)	4.89	4.90	4.86
Chotua (Feb – Mar)	4.16	4.16	4.11
SEm±	0.01	0.01	0.03
CD (0.05)	0.03	0.04	0.10
Persea bombycina Kost (1st to 5th)	4.70	4.71	4.68
Litsea monopetala Roxb (1st to 5th)	4.91	4.92	4.89
Persea bombycina Kost(1st to 3rd) + *Litsea monopetala* Roxb(4th to 5th)	4.75	4.76	4.70
Litsea monopetala Roxb (1st to 3rd) + *Persea bombycina* Kost (4th to 5th)	4.62	4.64	4.58
SEm±	0.01	0.01	0.03
CD (0.05)	0.03	0.04	0.10

The data further revealed that host plants had significant effect on shell weight. *Litsea monopetala* Roxb (1st to 5th) recorded significantly highest shell weight as compared to remaining treatments except *Persea bombycina* Kost (1st to 5th) during the experimentation.

In 2016, significantly higher shell weight observed under the combination of Kotia crop with *Persea bombycina* Kost (1st to 5th) being statistically superior over the rest of the treatments.

The figure in Table 4 has shown that, rearing season and host plantshad significant effect on pupal weight during the study.

Pupal weight (g) as influenced by different rearing crops and host plants was significantly affected during the study. Among the rearing crops, Kotia crop has resulted in significantly higher pupal weight as compared to puapl weight under Bhodia and Chotua crops. However, Jehtua crop was as effective as the Kotia rearing crop.

Among the host plants, *Persea bombycina* Kost (1st to 5th) was significantly affected the Pupal weight. Second best treatment recorded in pupal weight was *Persea bombycina* Kost (1st to 3rd) + *Litsea monopetala* Roxb (4th to 5th) and this treatment was significantly superior over Som (1st to 5th) and *Litsea monopetala* Roxb (1st to 3rd) + *Persea bombycina* Kost (4th to 5th).

Interaction effect found significantly in pupal weight in the year of 2016 and 2017. While, in 2018, it found non significantly. Combination of Kotia with *Persea bombycina* Kost (1st to 3rd) + *Litsea monopetala* Roxb(4th to 5th) recorded significantly higher pupal weight as comparison to the rest of the treatments in first two year of experimentation.

Observations related with larval weight as influenced by rearing season and host plant indicated that the impact was significant during the study (Table 5).

Table 2. Effect of different rearing seasons and host plants on Shell weight (g) of Muga silkworm.

Treatments	Shell Weight (g)		
	2016	2017	2018
Kotia (Oct – Nov)	0.498	0.504	0.516
Jethua (April – May)	0.497	0.497	0.505
Bhodia (Aug – Sept)	0.483	0.490	0.494
Chotua (Feb – Mar)	0.414	0.415	0.423
SEm±	0.002	0.004	0.005
CD (0.05)	0.006	0.012	0.014
Persea bombycina Kost (1st to 5th)	0.485	0.492	0.498
Litsea monopetala Roxb (1st to 5th)	0.480	0.487	0.493
Persea bombycina Kost(1st to 3rd) + *Litsea monopetala* Roxb(4th to 5th)	0.467	0.473	0.479
Litsea monopetala Roxb (1st to 3rd) + *Persea bombycina* Kost (4th to 5th)	0.455	0.462	0.468
SEm±	0.002	0.004	0.005
CD (0.05)	0.006	0.012	0.014

Table 3. Effect of different rearing seasons and host plants on Shell Ratio (%) of Muga silkworm.

Treatments	Shell Ratio (%)		
	2016	2017	2018
Kotia (Oct – Nov)	10.04	10.06	10.38
Jethua (April – May)	9.98	10.02	10.35
Bhodia (Aug – Sept)	9.88	10.00	10.16
Chotua (Feb – Mar)	9.95	9.97	10.29
SEm±	0.03	0.02	0.03
CD (0.05)	0.06	0.04	0.05
Persea bombycina Kost (1st to 5th)	10.32	10.45	10.64
Litsea monopetala Roxb (1st to 5th)	9.78	9.90	10.08
Persea bombycina Kost(1st to 3rd) + *Litsea monopetala* Roxb(4th to 5th)	9.83	9.94	10.19
Litsea monopetala Roxb (1st to 3rd) + *Persea bombycina* Kost (4th to 5th)	9.85	9.96	10.22
SEm±	0.03	0.05	0.07
CD (0.05)	0.06	0.10	0.17

Among the different rearing season, Kotia was recorded significantly superior over the rest of the treatment. The second best rearing season was Jethua and this season recorded significantly higher larval weight as compared to Bhodia and Chotua rearing season and significantly lower as compared to Kotia rearing.

Hostplants also affect larval weight significantly. *Litsea monopetala* Roxb (1st to 5th) has resulted in significantly higher larval weight than the other host plants treatment. While *Litsea monopetala* Roxb (1st to 3rd) + *Persea bombycina* Kost (4th to 5th), recorded significantly lower larval weight as compared to the rest of the treatment.

Interaction of larval weight was significantly affected by rearing seasons and host plants throughout the experiments. Kotia crop with *Persea bombycina* Kost (1st to 3rd) + *Litsea monopetala* Roxb(4th to 5th) recorded significantly superior over the rest of the treatments except Kotia crop with *Litsea monopetala* Roxb (1st to 5th) which was significantly at par with best treatment combination during experimentation. The data pertaining to larval duration (days) of Muga silkworm was recorded and presented in Table 6.

It is evident from the analysed result that Chotua rearing crop possessed significant highest larval duration as compared to the rest of the treatment. The second longest duration was recorded in Kotia rearing crops which was significantly lower to Chotua crop and statistically at par with the Jethua and Bhodia rearing crops.

Table 4. Effects of different rearing season and host plant on Pupal weight (g) of Muga silkworms.

Treatments	Pupal Weight (g)		
	2016	2017	2018
Kotia (Oct – Nov)	4.51	4.56	4.19
Jethua (April – May)	4.49	4.54	4.18
Bhodia (Aug – Sept)	4.45	4.51	4.13
Chotua (Feb – Mar)	3.70	3.75	3.37
SEm±	0.01	0.01	0.01
CD (0.05)	0.02	0.02	0.04
Persea bombycina Kost (1st to 5th)	4.25	4.30	3.95
Litsea monopetala Roxb (1st to 5th)	4.42	4.47	4.08
Persea bombycina Kost(1st to 3rd) + *Litsea monopetala* Roxb(4th to 5th)	4.29	4.34	3.96
Litsea monopetala Roxb (1st to 3rd) + *Persea bombycina* Kost (4th to 5th)	4.20	4.25	3.88
SEm±	0.01	0.01	0.01
CD (0.05)	0.02	0.02	0.04

Table 5. Effects of different rearing season and host plant on Larval weight (g) of Muga silkworms.

Treatments	Larval Weight (g)		
	2016	2017	2018
Kotia (Oct – Nov)	11.90	12.50	11.54
Jethua (April – May)	9.22	9.81	8.85
Bhodia (Aug – Sept)	8.79	9.43	8.45
Chotua (Feb – Mar)	7.32	7.96	7.01
SEm±	0.02	0.07	0.10
CD (0.05)	0.05	0.21	0.28
Persea bombycina Kost (1st to 5th)	8.95	9.58	8.58
Litsea monopetala Roxb (1st to 5th)	10.42	11.02	10.08
Persea bombycina Kost(1st to 3rd) + *Litsea monopetala* Roxb(4th to 5th)	9.20	9.87	8.91
Litsea monopetala Roxb (1st to 3rd) + *Persea bombycina* Kost (4th to 5th)	8.66	9.24	8.28
SEm±	0.02	0.07	0.10
CD (0.05)	0.05	0.21	0.28

Table 6. Effects of different rearing season and host plant on Larval duration (days) of Muga silkworms.

Treatments	Larval duration (days)		
	2016	2017	2018
Kotia (Oct – Nov)	23	22	23
Jethua (April – May)	22	21	22
Bhodia (Aug – Sept)	22	21	22
Chotua (Feb – Mar)	37	36	34
SEm±	0.24	0.24	0.24
CD (0.05)	0.69	0.69	0.69
Persea bombycina Kost (1^{st} to 5^{th})	25	24	25
Litsea monopetala Roxb (1^{st} to 5^{th})	26	26	26
Persea bombycina Kost(1^{st} to 3^{rd}) + *Litsea monopetala* Roxb(4^{th} to 5^{th})	26	26	26
Litsea monopetala Roxb (1^{st} to 3^{rd}) + *Persea bombycina* Kost (4^{th} to 5^{th})	25	25	25
SEm±	0.24	0.24	0.24
CD (0.05)	0.69	0.69	0.69

An examination of data further revealed that host plants also gave a significant result regarding larval duration. Maximum larval duration of Muga silkworm was recorded with *Litsea monopetala* Roxbs (1^{st} to 5^{th}) which was statistically at par with remaining all the treatments during all the year of investigation.

Conclusion

The Kotia season in Soalu plant, i.e.T2 registered higher larval weight (g), cocoon weight (g). as compare to the rest of treatments which helpful for utilization for production of seed. However, Som fed batch showed higher SR% than other treatments in commercial crop which indicated higher silk content. Through our study it is also established that If there is a lack of Som leaves during commercial rearing, then the way of rearing procedure in T-4 can be followed, i.e Chawki rearing can be done in Soalu plants and then transferred to Som plants for late age rearing.

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