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INFLUENCE OF HOST PLANT SELECTION ON THE GROWTH, SURVIVAL, AND REPRODUCTIVE PERFORMANCE OF MUGA SILKWORMS (*ANTHERAEA ASSAMENSIS* HELFER) DURING THE KOTIA COMMERCIAL CROP SEASON

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ABSTRACT

This study evaluates the effects of different host plants and their combinations on the growth, survival, and reproductive performance of Muga silkworms (*Antheraea assamensis* Helfer) during the Kotia commercial crop season (October-November). Using pooled analysis and Duncan Multiple Range Test (DMRT), we compared various parameters including larval weight, cocoon weight, shell weight, pupal weight, silk ratio, mortality rate, effective rate of rearing (ERR), pupation, natural and mechanical coupling, fecundity, and hatching rates across different treatments. The results highlight the superior performance of the Som (SM) host plant, which consistently showed the highest values for larval weight, cocoon weight, shell weight, pupal weight, silk ratio, and ERR. Combinations involving Som and Soalu (SL) also demonstrated strong performance. Conversely, treatments involving Mejankari (MJ) exhibited lower performance, especially when combined with Dighloti (DG), which resulted in the highest mortality rates and the lowest ERR. This study underscores the critical role of selecting optimal host plants for enhancing the productivity and quality of Muga silk production.

***Keywords*:** Muga silkworm, Som, Soalu, Dighloti, Mejankari, Grainage.

Introduction

The Muga silkworm, a polyphagous and multivoltine insect, thrives outdoors, feeding on a diverse array of trees encompassing a wide range of host plants **(**Jigyasu *et al*., 2023; Arunkumar *et al*., 2022; Singh *et al*., 2022; Subrahmanyam *et al*., 2024; Keisa *et al*., 2024; Arunkumar *et al*., 2024; Singh *et al*., 2024; Jigyasu *et al*., 2024a; Sangannavar *et al*., 2024; Jigyasu *et al*., 2024; Luikham *et al*., 2024**)**. It is reared throughout the year as pre-seed Jarua (December-January) and Aherua (June-July), seed Chotua (February-March) and Bhodia (August-September), and commercial crops in Jethua (April-May) and Kotia (October-November). Many of the food plants sources are perennial trees, found abundantly across various geographical regions. Among the numerous food plants of the Muga silkworm, Som (*Persea bombycina*) and Soalu (*Litsea monopetala*) serve as primary host plants and are utilized for the commercial crops, while Dighloti (*Litsea salicifolia*) and Mejankari (*Litsea citrata*) act as secondary food plants and are rarely used (Jigyasu *et al*., 2023; Jigyasu *et al*., 2024a; Jigyasu *et al*., 2024b).

Due to its polyphagous nature, the Muga silkworm exhibits an impressive capacity to consume a wide variety of plant species. However, Som and Soalu are particularly significant as primary host plants, while Dighloti and Mejankari play secondary roles in its diet. Research indicates that host plants significantly influence the economic parameters of Muga cocoon production, including the production of offsprings (Jigyasu *et al*., 2023). Moreover, it is worth noting that the nutritional composition of leaves from different host plants varies across different seasons of the year (Jigyasu *et al*., 2024a, b; Sangannavar *et al*., 2024). Muga silkworm fed on Dighloti tree during early age

rearing (up to 2nd instar) and subsequently transferred to Som or Soalu tree produced good quality of cocoons (Mech *et al*., 2015; Mech & Vijay, 2020; Mech & Vijay, 2022).

The aim of this research was to explore how variations in host plant selection impact key parameters related to Muga silkworm production, shedding light on optimal choices for enhancing cocoon quality and overall productivity. By understanding the intricate relationship between host plants and Muga silkworms, this research endeavour seeks to contribute valuable insights into the sustainable management and optimization of Muga silk production by utilizing primary and secondary food plants separately and in combinations in the commercial crop (Kotia; October-November).

Materials and Methods

Muga silkworm rearings were systematically conducted across commercial crop (Kotia; October-November in 2022 and 2023) adhering to standard rearing management protocols and practices. Following are the solo and combination treatments used for assessing the influence of host plant selection on the growth, survival, and reproductive performance of Muga Silkworms (*Antheraea assamensis* Helfer) during the Kotia commercial crop season:

Solo Rearing (1st to 5th Instar)	**Combinations of Host Plants** (1st to 3rd + 4th to 5th Instar)		
Som (SM)	SM+SL	SM+DG	SM+MJ
Soalu (SL)	SL+SM	SL+DG	SL+MJ
Dighlothi (DG)	DG+SM	DG+SL	DG+MJ
Mejankari (MJ)	MJ+SM	MJ+SL	MJ+DG

For the assessment of rearing performance, Effective rate of rearing (ERR %), Weight of matured worms (g), Single cocoon weight (g), Cocoon shell weight (g) and Cocoon shell ratio (SR %) were recorded. Grainage was conducted to produced seed (DFLs) obtained from all rearing crops, utilizing different food plants or combinations grainage parameters were recorded. Results were statistically analysed.

Results and Discussion

The table 1 presents a pooled analysis of male and female Muga silkworm rearing data, using the Duncan Multiple Range Test (DMRT) to compare different treatments during the Kotia commercial crop season (October-November). The superscript letters (a, b, c, etc.) next to the values indicate groups that are not significantly different from each other according to the DMRT at the 5% significance level. The treatments involve rearing silkworms on different host plants and their combinations. The values are followed by superscript letters indicating the statistical significance of differences between treatments.

The highest male larval weight was observed in silkworms reared on Som (SM) (9.37g), significantly higher than most other treatments. Silkworms reared on combinations of Som with Soalu (SM+SL) and Som alone (SM) also showed high weights. The highest female larval weight was recorded for Som (SM) (11.94g), followed by Soalu (SL) (10.63g), and the combination SM+SL (10.98g).

The highest male cocoon weight was found in silkworms reared on Som (6.07g), followed by the combination SM+SL (5.49g). These weights are significantly higher than those from other treatments. The highest cocoon weight for females was also recorded on Som (8.69g), followed by SM+SL (7.64g).

The highest male shell weight was on Som (0.49g), followed by SM+SL (0.43g). The highest female shell weight was also on Som (0.64g), followed by SL (0.53g) and SM+SL (0.49g). The highest male silk ratio was observed on Soalu (SL) (9.07%), followed by the combination DG+SL (8.24%). Som had a slightly lower ratio (8.18%). The highest silk ratio for females was recorded on DG+MJ (8.43%), with Som (7.41%) and Soalu (7.96%) also showing high values. The combination of Som and Soalu (SM+SL) also yields strong results, indicating that a mixed diet can sometimes be beneficial. Treatments involving Mejankari (MJ), both alone and in combinations, generally resulted in lower weights and silk ratios, indicating less suitability as a host plant.

Table 1: Pooled analysis of male and female rearing data and Duncan Multiple Range Test of different treatments in Commercial Crop (Kotia season, October-November).

Treatments	Larval Wt. (g) M	Larval Wt. (g) F	Cocoon Wt. (g) M	Cocoon Wt. (g) F	Shell Wt. (g) M	Shell Wt. (g) F	Pupal Wt. (g) M	Pupal Wt. (g) F	Silk Ratio (%) M	Silk Ratio (%) F
SOM (SM)	9.37^{a}	11.94^{a}	6.07^{a}	8.69^{a}	0.49^{a}	0.64^{a}	5.58^{a}	8.05^{a}	8.18^{ab}	7.41^{abcd}
SOALU (SL)	8.89^{ab}	10.63^{bc}	4.86^{b}	6.70^{c}	0.43^{ab}	0.53^{b}	4.43^{b}	6.17^{c}	9.07^{a}	7.96^{ab}
DIGHLOTI (DG)	6.37^{cdef}	8.40^{ghi}	4.30^{bcd}	5.47^{defg}	0.32^{cde}	0.37^{fg}	3.98^{bc}	5.09^{def}	7.55^{abc}	6.97^{bcd}
MEJANKARI (MJ)	6.28^{cdef}	7.57^{j}	3.70^{d}	4.55^{h}	0.27^{def}	0.29^{h}	3.43^{c}	4.25^{g}	7.43^{abc}	6.66^{bcd}
SM+SL	9.26^{a}	10.98^{b}	5.49^{a}	7.64^{b}	0.43^{ab}	0.49^{bc}	5.06^{a}	7.15^{b}	7.79^{abc}	6.41^{d}
SM+DG	6.93^{cde}	9.42^{de}	4.75^{bc}	5.98^{d}	0.37^{bc}	0.47^{cd}	4.38^{b}	5.51^{d}	7.90^{ab}	7.92^{abc}
SM+MJ	5.73^{f}	8.07^{hij}	4.06^{d}	5.06^{fgh}	0.29^{cdef}	0.40^{efg}	3.76^{bc}	4.66^{efg}	7.47^{abc}	7.93^{abc}
SL+SM	8.28^{b}	10.01^{cd}	4.31^{bcd}	5.71^{def}	0.33^{cde}	0.43^{def}	3.99^{bc}	5.28^{def}	7.66^{abc}	7.61^{abcd}
SL+DG	6.19^{def}	8.55^{fgh}	3.89^{d}	5.25^{efgh}	0.29^{cdef}	0.41^{ef}	3.59^{c}	4.84^{defg}	7.68^{abc}	7.83^{abc}
SL+MJ	5.98^{ef}	7.98^{hij}	4.02^{d}	5.23^{efgh}	0.23^{f}	0.34^{gh}	3.79^{bc}	4.89^{defg}	5.64^{c}	6.56^{cd}
DG+SM	7.17^{c}	9.13^{efg}	4.26^{bcd}	5.64^{def}	0.28^{cdef}	0.39^{efg}	3.98^{bc}	5.25^{def}	6.72^{bc}	6.99^{bcd}
DG+SL	6.75^{cde}	9.02^{efg}	4.18^{cd}	5.78^{de}	0.34^{cd}	0.45^{cde}	3.84^{bc}	5.32^{de}	8.24^{ab}	7.85^{abc}
DG+MJ	5.96^{ef}	7.40^{j}	3.74^{d}	4.70^{h}	0.26^{def}	0.39^{efg}	3.48^{c}	4.31^{g}	7.05^{abc}	8.43^{a}
MJ+SM	7.11^{cd}	9.02^{efg}	4.13^{cd}	5.45^{defg}	0.28^{cdef}	0.39^{efg}	3.85^{bc}	5.06^{def}	6.94^{abc}	7.23^{abcd}
MJ+SL	6.49^{cdef}	9.22^{ef}	4.06^{d}	5.68^{def}	0.31^{cdef}	0.40^{efg}	3.76^{bc}	5.28^{def}	7.58^{abc}	6.96^{bcd}
MJ+DG	5.75^{f}	7.66^{ij}	3.86^{d}	4.93^{gh}	0.26^{ef}	0.31^{h}	3.61^{c}	4.62^{fg}	6.76^{bc}	6.36^{d}
Grand Mean	7.03	9.06	4.36	5.78	0.32	0.42	4.03	5.36	7.48	7.32
CD (5%)	1.90	1.89	0.85	0.54	0.06	0.05	0.56	0.54	1.75	1.10

The table 2 presents a pooled analysis of average male and female Muga silkworm rearing data and survivability using the Duncan Multiple Range Test (DMRT) to compare different treatments. The average larval weight was highest for Som (SM) at 10.55g, significantly greater than most other treatments, indicating the superior nutritional quality of Som as a host plant. The combination SM+SL (10.05g) also performed well, close to the Som treatment. Som (SM) had the highest average cocoon weight at 7.38g, again highlighting its effectiveness as a host plant. The combination SM+SL had the second highest cocoon weight at 6.57g. Som (SM) produced the highest average shell weight at 0.57g, followed by Soalu (SL) at 0.48g, and the combination SM+SL at 0.46g. The highest average pupal weight was observed in the Som treatment (6.82g), indicating healthy and well-nourished larvae. The SM+SL combination also had a high pupal weight at 6.11g. The highest silk ratio was recorded for Soalu (SL) at 8.52%, indicating efficient silk production whereas other treatments with high silk ratios include DG+SL (8.05%) and SM (7.8%). The lowest mortality rate was observed for Dighloti (DG) at 35.5%, indicating better survival rates. The highest mortality rates were found in treatments involving Mejankari (MJ), particularly MJ+DG (77.5%) and MJ (73.17%). The highest effective rate of rearing (ERR) was recorded for Som (SM) at 51.70%, reflecting a high rate of successful rearing. The lowest ERR, observed in the MJ+DG combination at 21.21%, indicates the silkworms' refusal behavior when transitioning from MJ to DG plants. Som (SM) consistently showed the best results across multiple parameters, including larval weight, cocoon weight, shell weight, pupal weight, silk ratio, and effective rate of rearing. This indicates that Som is the most suitable host plant for rearing Muga silkworms.

Table 2: Pooled analysis of average rearing data and Duncan Multiple Range Test of different treatments in Commercial Crop (Kotia season, October-November).

Treatments	Larval Wt. (g) avg.	Cocoon Wt. (g) avg.	Shell Wt. (g) avg.	Pupal Wt. (g)	Silk Ratio (%)	Mortality (%)	ERR (%)
SOM (SM)	10.55^{a}	7.38^{a}	0.57^{a}	6.82^{a}	7.8^{abc}	48.83^{d}	51.70^{a}
SOALU (SL)	9.67^{bc}	5.78^{c}	0.48^{b}	5.3^{c}	8.52^{a}	53.83^{cd}	44.25^{b}
DIGHLOTI (DG)	7.37^{efg}	4.89^{ef}	0.35^{efg}	4.54^{e}	7.26^{bcde}	35.5^{e}	34.26^{de}
MEJANKARI (MJ)	6.94^{fg}	4.13^{i}	0.29^{g}	3.84^{g}	7.04^{bcde}	73.17^{ab}	27.74^{efgh}
SM+SL	10.05^{ab}	6.57^{b}	0.46^{bc}	6.11^{b}	7.1^{bcde}	59.17^{c}	41.26^{bc}
SM+DG	8.26^{d}	5.37^{d}	0.42^{cd}	4.95^{cd}	7.91^{abc}	51^{d}	37.20^{cd}
SM+MJ	6.81^{g}	4.56^{fghi}	0.35^{efg}	4.21^{efg}	7.7^{abcd}	67.83^{b}	30.74^{def}

SL+SM	9.26^{c}	5.02^{de}	0.38^{def}	4.64^{de}	7.64^{abcd}	50.5^{d}	43.26^{bc}
SL+DG	7.42^{ef}	4.57^{fghi}	0.36^{ef}	4.22^{efg}	7.75^{abc}	39.83^{e}	32.24^{def}
SL+MJ	6.98^{fg}	4.63^{efgh}	0.29^{g}	4.34^{ef}	6.1^{e}	72.17^{ab}	26.76^{fgh}
DG+SM	8.18^{d}	4.95^{ef}	0.34^{fg}	4.61^{de}	6.86^{cde}	40.5^{e}	34.24^{de}
DG+SL	7.72^{de}	4.98^{def}	0.4^{de}	4.58^{de}	8.05^{ab}	35.17^{e}	30.25^{efg}
DG+MJ	6.73^{g}	4.22^{hi}	0.33^{fg}	3.89^{g}	7.74^{abc}	75.83^{a}	23.75^{gh}
MJ+SM	8.07^{d}	4.79^{efg}	0.34^{fg}	4.46^{ef}	7.08^{bcde}	72.5^{ab}	26.24^{fgh}
MJ+SL	7.94^{de}	4.87^{ef}	0.35^{efg}	4.52^{ef}	7.27^{bcde}	71.83^{ab}	27.26^{fgh}
MJ+DG	6.74^{g}	4.4^{ghi}	0.29^{g}	4.11^{fg}	6.56^{de}	77.5^{a}	21.21^{h}
Grand Mean	8.04	5.07	0.37	4.70	7.40	57.82	33.28
CD (5%)	0.51	0.35	0.04	0.35	0.93	5.47	5.63

The highest pupation rate was observed in the Som (SM) treatment at 85%, indicating that silkworms reared on Som had the highest survival rate to the pupal stage shown in table 3. Soalu (SL) also showed a high pupation rate of 82%, followed closely by Dighloti (DG) at 81%. The lowest pupation rates were found in the MJ+SL (51%) and MJ+SM (53%) treatments, indicating poorer survival to the pupal stage when these combinations were used.

Natural coupling was highest in the DG+MJ and MJ+SL treatments, both at 50%, suggesting better natural mating behavior in these combinations. No natural coupling was observed in treatments involving Dighloti (DG) alone or in combination with other plants like SM, SL, or MJ. The highest percentage of egg retention was found in the SM+MJ and MJ+DG treatments, both at 19%, indicating that more eggs were retained and less were laid. The lowest egg retention, at 10%, was observed in several treatments including Som (SM), Soalu (SL), SM+DG, SL+SM, and SL+MJ. The highest fecundity was recorded when silkworm grown on Soalu (SL) at 203 eggs, indicating high reproductive performance on this host plant. Other high fecundity rates were observed in Som (SM) at 182 eggs and SL+SM at 176 eggs. The lowest fecundity was found in the MJ+DG treatment at 77 eggs.

The highest hatching rate was seen in SM at 73.06%, showing that a higher percentage of eggs hatched successfully in this treatment. SL+SM also had a high hatching rate at 68.75%. The lowest hatching rates were found in MJ+DG (43.91%) and MJ+SL (45.56%), indicating poorer egg viability or hatching conditions. The present study demonstrated the significance of different host plants, both individually and in combinations, on various parameters of muga silkworm rearing. These parameters include larval weight, cocoon weight, shell weight, silk ratio, mortality rate, effective rearing rate, pupation, and mating type (natural and mechanical), as well as their impact on fecundity and egg retention.

Table 3: Pooled analysis of average grainage data and Duncan Multiple Range Test of different treatments in Commercial Crop (Kotia season, October-November).

Treatments	Pupation (%)	Natural Coupling (%)	Mechanical Coupling (%)	Egg retained (%)	Fecundity (No.)	Hatching (%)
SOM (SM)	85	35	65	10	182^{ab}	73.06^{a}
SOALU (SL)	82	27	73	10	203^{a}	61.68^{abc}
DIGHLOTI (DG)	81	0	100	12	108^{efg}	57.77^{bcde}
MEJANKARI (MJ)	71	17	83	16	106^{efg}	55.63^{cde}
SM+SL	73	27	73	11	168^{bc}	58.86^{bcd}
SM+DG	68	0	100	10	147^{cd}	53.49^{cde}
SM+MJ	61	17	83	19	106^{efg}	47.73^{de}
SL+SM	78	33	68	10	176^{abc}	68.75^{ab}
SL+DG	65	0	100	12	121^{def}	52.32^{cde}
SL+MJ	54	0	100	12	90^{fg}	46.61^{de}
DG+SM	62	42	58	13	118^{def}	47.87^{de}
DG+SL	61	25	75	11	133de	50.36^{cde}
DG+MJ	58	50	50	11	101^{efg}	51.12^{cde}
MJ+SM	53	25	75	12	104^{efg}	51.31^{cde}
MJ+SL	51	50	50	15	90^{fg}	45.56^{de}
MJ+DG	63	0	100	19	77^{g}	43.91^{e}
Grand Mean	67	22	78	10	127	54.12

Conclusion

The present study provides a comprehensive analysis of the impact of different host plants and their combinations on various aspects of Muga silkworm rearing during main commercial crop Kotia (October-November, 2022 and 2023). Overall, this study emphasizes the importance of selecting the right host plants for optimizing the rearing and production of Muga silk. The findings suggest that while Som (SM) remains the most effective host plant, certain combinations like SM+SL can also enhance rearing outcomes. Conversely, the use of Mejankari, particularly in combination with Dighloti, should be approached with caution due to its negative impact on silkworm performance. These insights can guide sericulture practices to improve the productivity and quality of Muga silk.

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