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QUALITATIVE AND QUANTITATIVE STUDY OF DIETARY CHANGES ON COCOONS OF *ANTHERAEA MYLITTA* D.

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ABSTRACT

Antheraea mylitta D. produced tasar silk is a high value natural animal fibre of great international market potential. The insect is cultured outdoor in natural surroundings gets affected by extreme weather, pests, diseases etc. which decrease its commercial production as well as productivity. To overcome these obstacles artificial culturing of insects in optimized temperature, nutrition, habitat etc. is being devised. In this study the quantitative and qualitative impact of dietary changes on insect has been studied by changing the primary food crop (*Terminalia arjuna*) to secondary food crop (*Terminalia belarica*) and vice-versa in seed crop and commercial crop season. The investigation found that this interchange of food plants is effective and alternative methods for larval culture of tasar worms for desired productivity (E.R.R.%) and quality of tasar cocoons (cocoons weight, shell weight and shell ratio) as well as the quality of tasar yarn (filament length and size of tasar yarn) of *Antheraea mylitta* D. The results were more favoured when food crop change was made from secondary to primary food plant. Results were of importance when experimental values were compared to its control in both interchange of food crop from primary to secondary and vise-versa in both seed crop and commercial crop season. These findings are encouraging for the production of tasar silk by rearing cocoons by artificial culture in Indian conditions.

KEYWORDS: *Antheraea mylitta*, tasar silk, Cocoons, dietary variations, Sericulture, Emergence, Seed crop, Commercial crop, Agronomics, primary food crop, secondary food crop.

INTRODUCTION

Sericulture is rearing of silkworm and an agro-based industry suited to Indian agronomics for the production of silk. Silk is the golden royal fibre and is one of the eco-friendly natural protein fibre used since ancient times. Silk is an animal protein fibre made up of fibroin and sericin proteins produced by the fifth instar silk larvae for spinning of the cocoon which provides shell for delicate caterpillar to pass the pupal stage inside it (Kohli & Khan et al, 1969; Koundinya & Thangavelu, 2005). Four important varieties of natural silks namely mulberry, tasar, eri and muga are produced by the sericigenous insects belonging to family Bombycidae and Saturniidae of order Lepidoptera (Jolly & Prasad, 1975). Among the silk producing insects *Antheraea* is purely local Asiatic genus which is reared in the tropical and temperate belts of India generally in natural condition only. In the non-mulberry sector the production of tasar silk by *Antheraea mylitta* D. and *Antheraea proylei* Jolly has great economic importance (Jolly & Choudhary et al, 1975). However, research has shown that their culture can be done in artificial condition as well. Among these conditions, study of the nutritional requirement of *A. mylitta* insect is very important which is essential for its growth, development and reproduction. The primary tasar host plant is *Terminalia arjuna* while secondary tasar host plant is *Terminalia beleriea* (Agrawal & Jolly et al, 1985; Das, Jolly, Shergil et al, 1974C; Rai & Aggarwal, et al., 2006). Some other primary and secondary host plants for the tasar culture are also available in the forest areas. Under the shortage of primary food plants, the secondary food plants are used for rearing the tasar silkworms. (Das & Jolly, 1974b) Apart from this culture of silkworms are also carried out on the artificial food under the laboratory condition. Food plants have definite effect on the rearing performance and quality of cocoons of *A. mylitta*.D. Close relationship is also found between cocoon quality and the leaves of the food plant eaten by the larvae of *A. mylitta*. (Alam et al, 1998; Akai, 2000) Foliar spray of urea and food adjuncts enhances cocoon production both qualitatively and quantitatively. Synthesis of artificial diet and rearing *A. mylitta* on it is found successful (Mohanthy, 2003). However, very few work in relation to food transfer technology has been carried out which creates a gap in understanding of relative impacts of food transfer from one to another dietary condition i.e. primary to secondary food plants and vice-versa on the quantitative and qualitative characters of silk producing insect tasar cocoon of *A. mylitta* D. (Kumar, R.K, 2016; Ekta, P. and Kumar, P. 2016, Mohanthy & Satapathy, et al., 2007, Singh et al, 2012). Thus it is important to understand the relative effects of transfer of food plant technique on the behavioural manifestations of tropical tasar silk insect *A. mylitta* D.

MATERIAL AND METHOD

Antheraea mylitta D. cocoons were collected from Ranchi and carefully transported to Bodh-Gaya. Healthy and equal weight and size cocoons were selected by simple microscopic examination for experiments and thereafter stored and acclimatised under the laboratory conditions prior to experimentations. The experiments related were carried out under optimized conditions of the sericulture laboratory. Healthy tasar cocoons of *A. mylitta* D. were reared and put into ventilated cage separately in hanging position in the form of garlands to provide natural disposition. After selective coupling, healthy eggs were collected on muslin cloth under grainage operations which were then disinfected by washing with 5% formalin solution for 5 minutes. Incubation of eggs were done in leaf-cup of tasar host plants at 28-30^{0}C for a weak or less till hatching and rearing of first stage tasar silkworm larvae immediately brushed on foliage of selected tasar host plants of primary (*Terminalia arjuna* and *Quercus serrata*) and secondary (*Terminalia belarica* and *Quercus incana*) nature. The grown up cocoons were evaluated for dietary changes during the seed crop season (July to August) and commercial crop season (September to October) of the primary and secondary host plant. The harvesting of the cocoons for different sets of food plants under the two different conditions of rearing categorised as interchange from primary to secondary food plants and vice-versa were separately carried out, labelled and analysed as per the requirement of the experiment.

RESULT AND DISCUSSION

The findings from the investigation suggest nutritional dietary changes play an important role in growth, development and reproduction of the insect larvae.Table1 presents a comparative detail of the quantitative and qualitative characters of *Antheraea mylitta* with respect to relative impact of transfer of food plants in a process of interchange of food plant from primary (*Terminalia arjuna*) to secondary (*Terminalia belerica*) i.e. (P – S) during the seed crop and commercial crop seasons. It accounts for the relative impact of interchange of food plants from P-S on the productivity (E.R.R.%) and quality of tasar cocoons (cocoons weight, shell weight and shell ratio) as well as the quality of tasar yarn (filament length and size of tasar yarn) of *Antheraea mylitta* which were evaluated during the seed crop and commercial crop seasons and results so obtained were recorded in table 1. Table 1 reveals the impact on rearing the tasar silk larvae at initial stages (Ist to IIIrd) on *Terminalia arjuna* (primary food plant) and thereafter its transfer for last stages (IVth and Vth) on *Terminalia belerica* (secondary food plant) i.e. transfer of food plant from primary to secondary on the quantity

and quality of tasar cocoons of *Antheraea mylitta* during the seed crop season. Table 1 clearly indicates that the experimental E.R.R.% (6.0%), cocoon weight (9.15gm.), shell weight (0.96gm.), shell ratio (9.13%), filament length (3588mtr.) and denier of tasar yarn (6D) of *Antheraea mylitta* are evidently inferior as compared to its control (E.R.R. 36%, cocoon weight 10.78gm., shell weight 1.39gm., shell ratio 10.97%, filament length 3588mtr. and denier 9D) where the larval rearing of *Antheraea mylitta* has been carried out for total period on the primary food plant, the *Terminalia arjuna* during the seed crop season. Likewise, during the commercial crop season, which clearly indicates that the E.R.R. (8.0%), cocoon weight (9.82gm.), shell weight (0.98gm.), shell ratio (10.24%), filament length (3596mtr.) and denier of tasar yarn (8D) of experimental set (transfer of food) are significantly lesser than the control (E.R.R.% 38.0%, cocoon weight 11.11gm., shell weight 1.48gm., shell ratio 11.33%, filament length 4612mtr. and denier 10D) during the commercial crop season as it is evidenced by the table 1.

The relative impacts of interchange of food plants from secondary to primary (S-P) on the productivities and qualities of tasar cocoons along with the qualities of tasar yarn of *Antheraea mylitta* during the seed crop and commercial crop seasons by rearing the tasar silk larvae at initial stages (Ist to IIIrd) on *Terminalia belerica* (secondary food plant) and thereafter its transfer for last stages (IVth and Vth) on *Terminalia arjuna* (primary food plant) were evaluated and the results so obtained are recorded in table 2. Table 2 reveals the comparative picture in relation to transfer of tasar larvae from the foliages of secondary food plant to primary food plant with respect to quantitative and qualitative characters of *Antheraea mylitta* and its impact during the seed crop and commercial crop seasons. The seed crop season experimental values for S-P (E.R.R.% (35.0%), cocoon weight (10.76gm.), shell weight (1.42gm.), shell ratio (11.83%), filament length (4599mtr.) and denier of tasar yarn (10.0D)) are evidently better than its control values (E.R.R.% (13.0%), cocoon weight (10.12gm.), shell weight (1.07gm.), shell ratio (10.82%), filament length (3593mtr.) and denier of tasar yarn (8D)). Likewise the impact of transfer of food plant from the foliages of S-P food plant with respect to productivity and quality of tasar cocoons of *Antheraea mylitta* during the commercial crop season is recorded with its control in table 2. Commercial crop season experimental values (E.R.R.% (37.0%) cocoon weight (10.85gm.), shell weight (1.51gm.), shell ratio (11.94%), filament length (4616mtr.) and denier of tasar yarn (11D)) of *Antheraea mylitta* show better result when compared to the control values which is in the tune of E.R.R.% (14.0%), cocoon weight (10.27gm.), shell weight (1.10gm.), shell ratio

(10.99%), filament length (3602mtr.) and denier of tasar yarn (9D) (Table 2) with respect to productivity and quality of tasar cocoons and tasar silk fibre for transfer of food from S-P.

Table1: Relative impacts of food transfer from natural diet to artificial on the productivities and qualities of tasar cocoons of *A. mylitta* during the seed crop and commercial crop seasons.

S.No.	Parameters of Evaluation (Av.)	Seed crop		Commercial crop		C.D. at 0.5% level for characters
		Experimental	control	Experimental	control	
1	E.R.R.%	6.0	36.0	8.0	38.0	**
2	Cocoon weight (gm.)	9.15	10.78	9.82	11.11	*
3	Shell weight (gm.)	0.96	1.39	0.98	1.48	*
4	Shell ratio (%)	9.13	10.97	10.24	11.33	*
5	Filament length (mtr.)	3588	4593	3596	4612	**
6	Denier of tasar yarn (D)	6 D	9 D	8 D	10 D	*

*****significant, ******highly significant, **NS**= Not significant

Table 2: Relative impacts of food transfer from artificial to natural diet on the productivities and qualities of tasar cocoons of A. *mylitta* during the seed crop and commercial crop seasons.

S. No	Parameters of Evaluation (Av.)	Seed crop		Commercial crop		C.D. at 0.5% level for characters
		Experimental	control	Experimental	control	
1	E.R.R.%	35.0	13.0	37.0	14.0	**
2	Cocoon weight (gm.)	10.76	10.12	10.85	10.27	NS
3	Shell weight (gm.)	1.42	1.07	1.51	1.10	*
4	Shell ratio (%)	11.83	10.82	11.94	10.99	*
5	Filament length (mtr.)	4599	3593	4616	3602	**
6	Denier of tasar yarn (D)	10 D	8 D	11 D	9 D	*

*****significant, ******highly significant, **NS**= Not significant

SUMMARY AND CONCLUSION

Qualitative and quantitative study of dietary changes on cocoons of *Antheraea mylitta* D. has been studied on the primary as well as secondary food plants for the total larval period which is feasible inspite of relative variations in its relative productivity (E.R.R. %), quality of tasar cocoons (cocoon weight, shell weight, shell ratio) and tasar silk yarn (filament length, denier of tasar yarn). Primary food plants (*T.arjuna and Q. serrata*) are more suited for the culture

of tasar larvae of *A. mylitta* D. than the secondary food plants (*T. belarica* and *Q. incana*) during both the seed crop and commercial crop seasons. Thus the interchange of food plants from primary to secondary and secondary to primary has emerged as the effective and alternative methods for larval culture of tasar worms for desired productivity and quality of tasar cocoons. The findings can have widespread impact on agronomics of sericulture in India for the production of tasar silk.

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