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ANALYSES OF NUTRITIONAL CONTENTS OF PRIMARY HOST PLANT LEAVES OF TROPICAL TASAR SILK MOTH, *Antheraea mylitta* IN MAYURBHANJ DISTRICT OF ODISHA

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ABSTRACT The tropical tasar silk moth *Antheraea mylitta* Drury is very important for the sericulture industry of India. The present study is aimed at investigating the nutritional constituents of the leaves of three major primary host plants in Mayurbhanj district of Odisha of tropical tasar silk moth, i.e., Asan (*Terminalia tomentosa*), Arjun (*Terminalia arjuna*) *and* Sal (*Shorea robusta*) to find out the better host plant. The concentrations of nutritional constituents, like protein, carbohydrate, ascorbic acid and total phenolics were determined. The result obtained were statistically analysed and it was found that the concentration of protein was highest in leaves of Asan and lowest in Arjun. The concentration of carbohydrate was found to be highest in leaves of Sal and lowest in Arjun. The concentration of ascorbic acid and total phenolics were found to be highest in Sal and lowest in Asan. Hence, from the present study it can be concluded that Sal is best host plant out of these three for commercial rearing of tasar.

KEYWORDS : *Antheraea mylitta,* host plant, protein, carbohydrate, ascorbic acid, phenolics.

INTRODUCTION

The tropical tasar silk moth *Antheraea mylitta* Drury is a major non-mulberry silk- worm which produces about 95% of the total wild silk in the world and thus, is a species of sericultural importance which has the potential for the second largest silk production among all the sericigenous insects (Akai, 2000). There are about 44 ecoraces of tasar silk moth which are distributed all along Central India (Mathur *et al.* 2005). The larvae of tropical tasar silkworm is phyto-polyphagous in nature, i.e., it feeds on the leaves of various primary and secondary host plants. Plants are the richest source of organic chemicals on earth and phytochemicals from plants tend to influence the life processes of various insects (Rajashekaragouda *et al.* 1997). The food plants of tropical tasar have been categorised as primary and secondary on the basis of preferential feeding and adaptations of these silkworms on them (Singh and Srivastava, 1997). The food plants which the silkworms normally prefer are called as primary host plants, other food plants on which the silkworm can sustain its life but normally do not prefer are known as secondary host plants (Jolly *et al*. 1974). The host plants affect the silk production of the insects profoundly, affecting survival behaviour, rate of quantity of food intake, digestion and assimilation which directly influence the growth and development of the silkworm (Krishnaswami *et al.* 1970). The tropical tasar silkworm feeds primarily on host plants, like Asan (*Terminalia tomentosa*) , Arjun (*Terminalia arjuna*) and Sal (*Shorea robusta*) and secondarily on more than two dozen host plants (Suryanarayana and Srivastava, 2005). The commercial rearing of tropical tasar is carried out mainly on these three host plants in India in general and Odisha in particular.

In the present study dietary constituents, like protein, carbohydrate, ascorbic acid and total phenolics concentrations of the leaf samples of above mentioned plants were estimated to find out which among these three is a better host plant for the commercial tasar rearing.

MATERIALS AND METHODS

Sample Preparation: The fresh green leaves of the Asan (*Terminalia tomentosa*) , Arjun (*Terminalia arjuna*) and Sal (*Shorea robusta*) were collected from the silkworm rearing fields of Mayurbhanj district of Odisha. The quantity of leaves taken from each type of plant was ten. The samples were placed in polyethylene bags and transported under refrigerated conditions to the laboratory. Samples received were washed under running tap water to remove the adhering dirt and then stored under -20° C until analysed. Analysis was completed within 24 hours of sample collection (Patra *et al.* 2013). All measurements were conducted in duplicates.

Tissue Preparation: Five grams of each leaf was homogenised in ice cold extraction buffer. The soluble protein concentration was determined in the supernatant after centrifuging the homogenate at 10,000 x g for 10 minute at 4°C (Patra *et al.* 2011). Carbohydrate, ascorbic acid and total phenolics content were determined in the supernatant.

Biochemical Estimation: The amount of proteins was determined by the method of Lowry *et al.* (1951) with bovine serum albumin as standard. The concentration of carbohydrate was estimated according to the method of Yemm and Willis (1954). Ascorbic acid concentration was measured according to the method of Jagota and Dani (1982). The concentration of total phenolics was measured according to method of Slinkard and Singleton (1977). The concentration was expressed per gram tissue wet weight.

Statistical Analysis : Results are presented as means ± standard deviation (S.D.). To know the difference between means of three dependent samples one-way analysis of variance (ANOVA) was employed (Chainy *et al*., 2015). As total leaf tissues were not possible to collect the amount of different nutritional parameters i.e. protein, carbohydrate, ascorbic acid and phenolics have been expressed as their concentration.

RESULTS

The studied biochemical constituents of collected tissue samples of the leaves have host plant specific variations among them. The concentration of protein was found to be highest in the host plant leaf Asan (*Terminalia tomentosa*) than that of the others and it was found least in Arjun (*Terminalia arjuna*) (Table 1). The concentration of carbohydrate and ascorbic acid were found highest in Sal (*Shorea robusta*) and least in the leaves of Arjun (*Terminalia arjuna*) (Table 1). The concentration of total phenolics was found to be highest in Sal (*Shorea robusta*) leaves and lowest in leaves of Asan (*Terminalia tomentosa*) (Table 1). All these findings were analysed through ANOVA. The details of the observations are expressed below.

One-way analysis of variance (ANOVA) of concentrations of protein in the leaf tissues were significantly different ($P < 0.01$) among Asan, Arjuna and Sal (Table 2). The concentration of carbohydrate in the leaf tissues were also significantly different ($P < 0.01$) among Asan (*Terminalia tomentosa*), Arjun (*Terminalia arjuna*) and Sal (*Shorea robusta*) (Table 3). Similarly, the concentrations of ascorbic acid and total phenolics in the various leaf tissues were significantly different (P

< 0.01) among Asan (*Terminalia tomentosa*) , Arjun (*Terminalia arjuna*) and Sal (*Shorea robusta*) (Tables 4 and 5).

Table 1. Concentrations of different nutritional constituents in leaves of three host plants Asan (*Terminalia tomentosa*), Arjun (*Terminalia arjuna*) and Sal (*Shorea robusta*) . (Data are mean ± SD, n = 10 each).

Nutritional Constiuents	ASAN	ARJUNA	SAL
Protein (mg/g)	203.063 ± 2.051*	157.29 ± 3.006	174.939 ± 3.52
Carbohydrate (mg/g)	3.107 ± 0.687*	2.347 ± 0.034	4.438 ± 0.205
Ascorbic Acid (µg/g)	1.465 ± 0.268*	1.347 ± 0.042	2.204 ± 0.024
Phenolics (mg/g)	1.607 ± 0.335*	2.828 ± 0.118	3.089 ± 0.100

* P< 0.01 in comparison between three different varieties of (ANOVA).

Table 2. Summary of computation for ANOVA of Protein concentration (mg/g) in the leaves of three host plants Asan (*Terminalia tomentosa*), Arjun (*Terminalia arjuna*) and Sal (*Shorea robusta*).

Source of variation	Degrees of freedom	Sum of squares	Mean squares	$F_{(cal)}$	Significance
Between groups	2	10658.71	5329.36	561.19	P < 0.01
With in groups	27	256.4	9.496		
Total	29	10915.12			

Table 3. Summary of computation for ANOVA of Carbohydrate concentration (mg/g) in the leaves of three host plants Asan (*Terminalia tomentosa*), Arjun (*Terminalia arjuna*) and Sal (*Shorea robusta*).

Source of variation	Degrees of freedom	Sum of squares	Mean squares	$F_{(cal)}$	Significance
Between groups	2	22.41	11.2	58.6	P < 0.01
With in groups	27	5.16	0.19		
Total	29	27.56			

Table 4. Summary of computation for ANOVA of Ascorbic acid concentration (µg/ml) in the leaves of three host plants Asan (*Terminalia tomentosa*), Arjun (*Terminalia arjuna*) and Sal (*Shorea robusta*)

Source of variation	Degrees of freedom	Sum of squares	Mean squares	$F_{(cal)}$	Significance
Between groups	2	4.315	2.157	78.1	P<0.01
With in groups	27	0.746	0.028		
Total	29	5.061			

Table 5. Summary of computation for ANOVA of Total Phenolics concentration (mg/ml) in the leaves of three host Asan (*Terminalia tomentosa*), Arjun (*Terminalia arjuna*) and Sal (*Shorea robusta*)

Source of variation	Degrees of freedom	Sum of squares	Mean squares	F(cal)	Significance
Between groups	2	12.518	6.259	123.6	P<0.01
With in groups	27	1.367	0.051		
Total	29	13.885			

DISCUSSION

The leaves enriched with protein show a significant enhancement of cocoon production (Deka and Kumari, 2013). Therefore the highest concentration of protein in Asan (*T. tomentosa*) leaves followed by a higher concentration of protein in Sal (*S. robusta*) leaves indicate suitability for tasar rearing. Carbohydrate is the main source of energy required for larval, pupal and adult transformation (Thangamani and Vivekanandan, 1984). Thus, the highest carbohydrate concentration in Sal (*S. robusta*) also indicates its nutritional superiority, whereas the lowest carbohydrate concentration in Arjun (*T. arjuna*) leaves seems not much encouraging for tasar rearing. Ascorbic acid acts as an anti-oxidant, which helps in fighting against reactive oxygen species (ROS) and provides stress resistance (Hodnick *et al.* 1989) and absence of ascorbic acid declines growth rate and elimination of drier faecal pellets in *A. mylitta* (Mohanty and Mitra, 1984). Highest concentration of total phenolics in the leaves of Sal (*S. robusta*) indicates its superiority due to its anti-oxidant effects (Summers and Felton, 1994). Besides own anti-oxidant status of the larva, the anti-oxidants present in food (host plant leaves) will be helpful in supplementing the fight against extreme environmental factors during different instars and pupation (Patra *et al.* 2011).

CONCLUSION

The present study provides a conclusion that though all the three primary host plants have necessary nutrients for tasar rearing, their nutritional quality surely varies. Sal (*Shorea robusta*) has almost all the nutritional parameters at a greater concentration than both Asan (*Terminalia tomentosa*) (except for protein which was found to be marginally more than that of Sal) and Arjun (*Terminalia arjuna*). Asan (*Terminalia tomentosa*) plant with its superior protein content is also a very suitable plant for tasar rearing. Though Arjun (*Terminalia arjuna*) has marginally less nutritional content than both Asan (*Terminalia tomentosa*) and Sal (*Shorea robusta*) still it is preferred because of its better adaptibility to various soil conditions. From the above study it can be concluded that of these three primary host plants, tasar culture should be more encouraged on Sal (*Shorea robusta*) which is now confined to only a few eco-pockets of Mayurbhanj district of Odisha.

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