Academic Journal of Plant Sciences 7 (2): 10-13, 2015
ISSN 1995-8986

DOI: 10.5829/idosi.ajps.2015.7.2.1118

Lagerstroemia Speciosa: A New Primary Food Plant of Indian Tropical Tasar Silkworm *Antheraea mylitta* D

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Abstract: *Terminalia arjuna* and *T. tomentosa* are slow growing plants and it takes minimum four/five years after plantation to take up silkworm rearing on these plants. The present study reports for the first time the rearing performance of tropical tasar silkworm *Antheraea mylitta* D. on the foliage of *Lagerstroemia speciosa vis a vis* on *T. arjuna* and *T. tomentosa* to find out the suitability of this species as an alternate primary food plant. From the present investigation it is found that on the foliage of *Lagerstroemia speciosa* silkworm rearing can be started after 2/3 years of plantation and two consecutive rearing can be taken up on *L.speciosa* plants whereas *T. arjuna* and *T.tomentosa* can sustain only one rearing in a year. First crop rearing results show that larval duration was slightly higher in *L. speciosa* (32 days) as compared to *T. arjuna* (28) and *T. tomentosa* (26 days).Similar trend was observed during second crop also where larval duration was maximum in *L. speciosa* (52 days) followed by *T.arjuna* (43) and *T. tomentosa* (42 days). ERR % was almost similar on all the food plants in both the crops. There is a slight difference in the single cocoon weight in all the three species however, the shell ratio in percent was minimum (12.23) in *T. tomentosa* as compared to *L. speciosa* (13.08) and *T. arjuna* (13.38). During second crop, silk ratio percent ranged between 14.55 in *T. arjuna* to 14.96 in *L. speciosa*. There was slight difference in the filament length in the cocoons harvested on *L. speciosa, T. arjuna* and *T. tomentosa* but non breakable filament length was almost similar in *T. arjuna* (366.25 m) and *L. speciosa* (364.75m).Grainage behavior in *L. speciosa* was at par with *T. arjuna.*

Key words: Lagerstroemia speciosa · *T. arjuna* · *T. tomentosa* · ERR % · Shell weight · Filament length · Non Breakable filament length · Denier · Silk weight · Grainage

INTRODUCTION

Ministry of rural development (MORD, Government of India and the United Nations Development Programme (UNDP) recognized potential contribution of tasar culture model for environmental sustainability through Greening Rural Development in India and making delivery of green results [1]. Tasar culture has also been recognized as one of the major Non-Timber forest Produce (NTFP) for livelihood creation for funding through its convergence initiatives by above agencies. Central Silk Board in association with sate government has launched various schemes e.g Cluster development and cluster promotion programmes (CDP, CPP), Mahila Krishi Shashktikaran Pariyojna (MKSP) and Swarnjayanti Gramin Swarojgar Yojna (SGSY) to improve the livelihood of the rural people through tasar culture. The main thrust is given for tropical tasar culture in traditional and non traditional states. For this, vast area is to be brought under systematic block plantation of tropical tasar silkworm food plants. Traditionally farmers conduct silkworm rearing on *Terminalia tomentosa* (naturally available in the forests) and *T.arjuna* plantation developed under block plantations. Both the species are very slow growing and only one rearing can be conducted on these plants. At this juncture a fast growing and easily propagated alternative primary food plant which can be used for silkworm rearing within a short period of 2/3 years and can support two consecutive rearing is the need of the hour. In an endeavor to achieve this, extensive programme was undertaken at Central Tasar Research and Training Institute, Ranchi, to find out a suitable plant which can be cultivated in systematic block plantation.

Lagerstroemia specisosa (*Jarul*, family Lythraceae) was one of the several species included in this programme. It is a fast growing medium sized to large

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deciduous or semi-deciduous tree up to 10 m tall. In India it is distributed more or less through out country up to an altitude of 600 m. Due to the tree's dense and wide spreading root system, it is used in erosion control and reforestation of degraded hills. It is also cultivated for ornamental purposes and as an avenue tree, boundary, barrier or support [2]. It is easy to propagate through cuttings and coppices freely. The crown of the tree is bushy and spreading making it most suitable for silkworm rearing.

Therefore, the present study was mainly aimed to find out the suitability of *L. speciosa* species as a primary food plant vis *a vis* on *T. arjuna* and *T. tomentosa* under block plantations.

MATERIALS AND METHODS

Rearing was conducted during July- August (First crop) and October November (Second crop) on 6 year old medium sized bushes of *Terminalia arjuna, T. tomentosa and Legerstroemia speciosa* planted under 2.40 X 1.80 m spacing in the field at Central Tasar Research and Training Institute, Ranchi. Basal application of recommended fertilizer dose of 100:50:50 kg of NPK/ha/year was applied in the plants [3, 4]. Plants were pruned immediately (Mid August) after completion of first crop rearing to find out the availability of foliage for second crop rearing (October - November) on the same bushes. Bivoltine commercial tropical tasar silkworm *Antheraea mylitta* D. race *Daba* was taken for evaluation of the rearing performance on the foliage of three species.

For each food plant 4000 newly hatched healthy larvae were separated into five groups of equal size and brushed on the foliage of *T. arjuna*, *T. tomentosa* and *L. speciosa* till the harvesting of cocoons. Standard package of practices were followed during the entire rearing period [4, 5]. First and second crop rearing was conducted on the same bushes in *L. speciosa* plants whereas, fresh patches of *T. arjuna* and *T. tomentosa* plants were utilized as sufficient quantity of foliage was not available on these plants.

Data on larval duration (days), mature larvae weight, effective rate of rearing (ERR% = 100 x total cocoons harvested / total larvae brushed), single cocoon weight, shell weight and shell ratio in percent were recorded. Total quantity of cocoon shell (raw silk) production based on average ERR% values x shell weight was calculated [6]. Cocoons were also assessed for standard reeling parameters in Post cocoon Technology Laboratory at the Institute. Biochemical estimation of chlorophyll, protein, phenol and proline were also done in the leaf [7]. The study was conducted during 2013 and 2014 in both the seasons and averages of all the data were analyzed statistically to evaluate the comparative rearing performance.

Grainage behaviour was observed in the cocoons harvested out of silkworm rearing on *Lagerstroemia speciosa* as well as *Terminalia arjuna* during first crop 2014.

RESULTS

Results of the first crop rearing performance on the foliage of *L. speciosa, T. arjuna* and *T. tomentosa* are presented in Table 1. Single larvae weight at maturity was highest in the worms reared on *T. tomentosa* (37.88g) followed by *T. arjuna* (36.53 g) and *L. speciosa* (32.47g). The larval duration was maximum in *L. speciosa* (32 days)

Table 1: Comparative rearing performance of *A. mylitta* D on *T. arjuna, T. tomentosa* and *L. speciosa,* in first crop (July-August).

	Species		
Parameters	*T. arjuna*	*T. tomentosa*	*L. speciosa*
Larval duration(days)	28	26	32
Mature single larvae weight (g)	36.53 ± 0.08	37.88 ± 0.02	32.47 ± 0.10
ERR(%)	50.6 ± 0.2	50.1 ± 0.2	50.00 ± 0.3
Single cocoon weight (g)	8.92 ± 0.22	9.60 ± 0.41	10.92 ± 0.58
Single shell weight (g)	1.05 ± 0.04	1.08 ± 0.07	1.44 ± 0.12
Silk Ratio (%)	11.71 ± 0.22	11.15 ± 0.29	13.11± 0.65
Total cocoon shell production	76.84 ± 2.04	75.83 ± 2.04	76.39 ± 4.18
Filament length (m)	630.40 ± 30.15	711.83 ± 39.70	695.42 ± 60.14
Number of breaks	1.33 ± 0.33	1.08± 0.34	2.00 ± 0.52
Silk weight (g)	0.68 ± 0.03	0.91± 0.10	0.64 ± 0.04
Waste weight (g)	0.23 ± 0.01	0.31 ± 0.02	0.31 ± 0.04
Non-breakable filament length (m)	345.42± 43.06	516.75± 82.44	340.17± 63.8
Denier	9.96 ± 0.06	10.76 ±.22	8.48 ± 0.29

± indicates Standard Error

Table 2: Comparative rearing performance of *A. mylitta* on *T. arjuna, T. tomentosa* and *L. speciosa,* in second crop (October-November).

	Species		
Parameters	*T. arjuna*	*T. tomentosa*	*L. speciosa*
Larval duration (days)	43	42	52
Mature single larvae weight (g)	35.27 ±0.33	37.70 ±0.15	30.26 ±0.14
ERR (%)	69.44 ±0.15	71.25 ±0.14	70.83 ±0.11
Single cocoon weight (g)	14.14 ± 0.56	13.18 ± 0.70	10.73 ± 0.39
Single shell weight (g)	2.04 ± 0.93	1.92 ± 0.13	1.59 ± 0.10
Silk Ratio (%)	14.55 ± 0.65	14.68 ± 0.94	14.96 ± 0.89
Total cocoon shell production	142.21 ± 6.57	137.6 ± 9.88	113.00 ± 7.23
Filament length (m)	611.67±35.65	672.22 ±29.85	581.22 ±31.25
Number of breaks	1.66 ± 0.18	1.83±0.16	2.41± 0.33
Silk weight (g)	0.66 ± 0.023	0.91±0.07	0.68 ±0.06
Waste weight (g)	0.23 ±0.01	0.30±0.01	0.60 ± 0.03
Non-breakable filament length (m)	366.25 ±36.34	486.41±74.37	364.75 ± 53.75
Denier	9.84±0.021	9.05±0.19	9.48 ±0.17

± indicates Standard Error

Table 3: Means value of different parameters for *T. arjuna,T. tomentosa* and *L. spe*ciosa.

Species	Total chlorophyll (mg/g)	Total phenols (µg/mg)	Reducing sugar (µg/mg)	Non reducing sugar (µg/mg)	Total proline (µmol/mg)	Total protein (mg/g)
T. arjuna	1.00	1.34	3.26	9.23	25.30	31.08
T. tomentosa	1.60	4.96	9.90	7.50	56.83	35.56
L. speciosa	1.07	5.6	6.10	6.80	55.80	35.80
CD 5%	0.15	0.11	0.38	0.44	2.93	0.97

followed by *T. arjuna* (28) and *T. tomentosa* (26 days). It is seen from the Table that ERR varied from 50% in *L. speciosa* to 50.6 % in *T. arjuna*. There is a slight difference in the single cocoon weight in all the three species however, the shell ratio in percent was minimum (12.23) in *T. tomentosa* as compared to *L. speciosa* (13.08) and *T. arjuna* (13.38). Filament length and non breakable filament length was similar in the cocoons of *L. speciosa* and *T. arjuna.* Denier was slightly less in *L. speciosa* (8.48) as compared to *T. arjuna* (9.96) and *T. tomentosa* (10.76).

Table 2 indicates the results of second crop rearing. Similar trend on the larval duration was observed in second crop also where it was maximum in *L.speciosa* (52 days) followed by *T. arjuna* (43) and *T. tomentosa* (42 days). Single larvae weight at maturity was highest in the worms reared on *T. tomentosa* (37.70g) followed by *T. arjuna* and *L. speciosa* (35.27 and 30.26 g, respectively). However, the ERR % was almost similar on all the food plants as was in first crop. Silk ratio in percent ranged between 14.55 in *T.arjuna* to 14.96 in *L. speciosa*. There was a slight difference in the filament length in the cocoons harvested on *L. speciosa, T. arjuna* and *T. tomentosa*. A slight increase in number of breaks was observed in the cocoons of *L. speciosa* but the non breakable filament length was almost similar in *T. arjuna* (366.25 m) and *L. speciosa* (364.75m). The Denier was 9.05 in *T. tomentosa*, 9.48 in *L. speciosa* and 9.84 in *T. arjuna*.

Biochemical studies in the leaf shows that total protein the main constituent of silk was in the range of 31.08 mg/g in *T.arjuna* to 35.80 mg/g in *L.speciosa* (Table 3). Total phenols were maximum in 5.6 µg/mg *L.speciosa* and minimum (1.34 µg/mg) in *T.arjuna*. Proline contents, indicator of tolerance to drought were maximum (55.80 µmol/mg) in *L.speciosa* followed by *T.tomentosa* 56.83 µmol/mg and 25.30 µmol /mg in *T.arjuna.*

Studies on grainage behaviour of the silkworms reared on *Lagerstroemia speciosa* reveal that an average of 210 eggs per 2 gram were obtained out of 10 couplings with hatching of 87.17 percent. On the other hand, 208 eggs per 2 gram were obtained from the silkworms reared on *Terminalia arjuna* with hatching of 79.14 per cent.

DISCUSSION

Tropical Tasar silkworm *Antheraea mylitta* D. is polypahagous and primarily feeds on *T. tomentosa* and *T. arjuna* [8]. Several reports are available on the rearing performance of tasar silkworm on primary (*T. tomentosa, T. arjuna*) and secondary food plants viz*., Anogeissus latifolia, Bauhinia variegate, Careya arborea,*

Hardwickia binata,, Lagerstroemia parviflora, L. indica, Shorea robusta, Terminalia paniculata and *Zizyphus jujube.* The results of these studies indicated that silk worms reared on *T. arjuna* and *T. tomentosa* gave better ERR (50%) then other plants where the average ERR was less then 20 percent [9-13]. Cocoon crop performance through several rearings of *A. mylitta* D. larva fed on primary and secondary food plants was also studied and it was concluded that the cocoon quantity and quality on the secondary food plants (Ber, Sal, Sidha and Dhawda) is much inferior in comparison to the primary food plants *i.e.* Arjun and Asan [6]. Studies also indicates that overall performance of rearing and grainage of *Antheraea mylitta* fed *L. parviflora* was poor as compared to *T. tomentosa* [14]. Present findings indicate that the silkworm rearing performance during first and second crop was almost similar on the plants of *L. speciosa* and *T. arjuna*. The slight increase in larval duration might be due to the high quantity of phenols in the leaves of *L. speciosa.* High quantity of proline in *L.speciosa* indicates its ability towards drought tolerance. Accumulation of high quantity of proline in barley leaves has been associated with drought tolerance [15]. Based on the findings, it is concluded that *L.speciosa* can be recommended for large scale block plantation/mixed plantations in rainfed areas for tropical tasar culture with an added advantage of its easy to propagate and fast growing nature. Moreover, it has an added advantage over *T. arjuna* and *T. tomentosa* that two consecutive tropical tasar silkworm rearing can be taken up on the same plantation which are not done on *T. arjuna* and *T. tomentosa* plants.

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