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Syzygium cumini L. - A potential new host of tropical tasar silkworm, *Antheraea mylitta* drury (lepidoptera - saturniidae)

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ABSTRACT

An attempt was made to rear the tasar silkworm, *Antheraea mylitta* Drury on the leaves of *Syzygium cumini (*jamun) for the first time in India and reared under indoor rearing condition. Jamun is a very common, large evergreen beautiful tree of Indian subcontinent. The scientific name of Jamun is *Eugenia jambolana* or *Syzygium cumini* L and it belongs to the myrtaceae plant family. It was observed that the jamun is a potential new host of tropical tasar silkworm. The growth parameters and cocoon characters of the tasar silkworm reared on jamun leaves were normal. The tasar silkworm successfully lasted its life cycle ranged from 65 to 70days. The effective rate of rearing, weight of pre-spinning larvae, cocoon, shell and pupae ranged from 75 to 80 per cent, 25 to 35 g, 10 to 12 g, 1.10 to 1.30g, 7 to 9 g, respectively. Parameters such as length of cocoon shell, peduncle, width of shell, peduncle, shell thickness etc. the fecundity ranged from 175 to 210 eggs. The finding of jamun as a potential new host for tropical tasar silkworm has opened new vistas in promoting vanya silk industry.

Keywords: Tasar silkworm, *Syzygium cumini* L, *Antheraea mylitta*, Indoor rearing.

1. Introduction

Jamun *Syzygium cumini* L can be used medicinally and it has a long tradition in alternative medicine. The bark has anti-inflammatory activity and is used In India for anemia, the bark and seed for diabetes which reduce the blood sugar level quickly, the fruit for dysentery and leave's juice for gingivitis (bleeding gums). The foliage serves as fodder, for cattle, especially during drought. The twigs form good datoon (tooth brush). The Jamun twig is also used as a rough painting brush for lettering addresses on ones gunny packs while moving household affects from one place to another. Unripe fruit is used for making vinegar. The juice is also criminating, diuretic and gives a soothing effect on human digestive system. Tropical tasar silkworm *Antheraea mylitta* Drury is not known to infest jamun crop in nature. The tropical tasar silkworm *A. mylitta* also called "vanya silkworm" is one of the commercially exploited silkworms reared outdoor [4]. *A. mylitta* D. a vanya sericigenous insect is widely distributed in from west Bengal in the east to Karnataka in the south with its natural inhabitation in forest. It is a polyphagus insect feeding on a number of food plants, like arjun, ain, sal, ber, etc. Among fourty four ecoraces of *A. mylitta* are seen [8, 9, 13]. Castor *Ricinus communis* L. is used for new host of *A. mylitta* reported [12]. Indoor rearing of tasar silkworm *A. mylitta* on *Terminalia catappa* Cooke leaves used for its food and rearing potential 40 percent reported [23, 25, 21]. Several workers have earlier reported a positive response of *A. mylitta* for indoor rearing. However, till now no serious effort being made to study from chawki stage to the cocoon stage [18, 5]. The available literature which is very much limited shows that have reported indoor chawki worm rearing of *A. mylitta* with an estimated ERR of less than 20% [19]. Though the findings are not encouraging, one aspect apparently becomes clear that *A. mylitta* is no averse to indoor rearing. Survey, Protection, Conservation and exploitation of more and more ecoraces of tasar silkworms is essential sustainable development of out country. Secondly, silk derived from tasar is economically viable which protect the man from certain diseases and bad effects of ultraviolet rays. Hence investigating standard technique for mass rearing of tasar silkworm *A. mylitta* is challenge to Sericulturists and scientific community.

In past, [1, 24, 7, 22, 17, 20] attempted the work related to rearing of wild tasar silkworms. Therefore, an attempt has been made to rear the insect from first instar to the last instar and allow for cocoon and adult formation.

2. Material and Method

The cocoons of *A. mylitta* were collected from host plants Arjun *(T. arjuna)*, Assan *(T.tomentosa)* and *Ber (Z. jujuba)* from Kolhapur region during the first week of April to June and the adults were allowed to emerge under laboratory conditions at 28 ± 2°C temperature , 75 ± 5% RH and 12 hrs photoperiod . Inside a moth cage made of nylon. Eggs were collected from floor, walls of the cage at room temperature of 28 ±2 ^{0}C, RH of 75 ± 5% and 12 hrs photoperiod. For this study, the indoor rearing methodology developed for *A. mylitta* was followed [12].

Newly hatched larvae were released on the leaves of the host plants Jamun *S. cumini* L with the help of soft camel hairbrush. 4 - 5 such leaves with mounted larvae were placed in the plastic box size 27 cm x 6 cm x 7 cm in length, width, and height respectively. The maximum portion of edge of each leaf was available to the larvae for feeding; the box was perforated with numerous exits for aeration and with covered lid to prevent escape of the larvae. Next day, the larvae were transferred to the new box containing fresh leaf diet. The moulting larvae transferred along with their support leaves. The old leaves were removed from the boxes at 12 hrs interval. Rearing of 1st and 2nd in stars for used boxes were then washed, disinfected and dried for re-use.

Rearing trays of size (3'x 2.5'x 6'in length x width x height respectively) were used for the rearing of 3rd, 4th and 5th instar larvae. A twig having 12 to 15 leaves was used as leaf diet 8 – 9 leaf twigs were introduced in the tray at a time. Larvae were transferred to a new trey along with help of new food. Touching with hand to food plants and silkworms was avoided mostly. The trays were cleaned after 24 hr interval. Moulting larvae was transferred along with the left over parts of the food plant.

The full grown 5th instar larvae wandering for cocoon construction were sorted out and transferred to a box (4'X 2.5'in height X width) made up of hard card sheet fitted with wooden rods and some old twigs that provided them opportunity to form the cocoons. The data was recorded for the study of biology, which includes larval duration, adult longevity and fecundity. Above species of silkworm sufficient number of silkworm (200) were used for confirming results. The rearing was conducted for two successive years i.e. June to December 2010, 2011.

3. Results and discussion

It was observed that there was less mortality of I st instar *A.mylitta* worms when fed with tender jamun leaves, indoor. The larvae of all the five instars fed upon matured, tender leaves and successfully complicated the life cycle. The result indicated that the rearing success of *A.mylitta* on jamun under indoor rearing conditions (28 ±2 ^{0}C and RH of 75 ± 5% and 12 hrs photoperiod) was 60%. The moths mated successfully laid fertilized eggs in the mud pot and covered with nylon mesh in rearing house. On jamun leaves, the incubation period, larval and pupal duration ranged from 10 days, 30 to 32 days, 25 to 30 days, respectively .the tasar silkworm moulted four times and there were five instars each lasted 3 to 3.5 ,2 to 2.5, 3.5 to 4, 5.5 to 6.5, and 8.5 to9.5 days, respectively. The weight of matured tasar silkworm (v th instar) was 25 to 35 g and measured 10 to 12.5 cm in length, 3.5 to 4.0 cm in circum. The weight of cocoon including pupa in indoor rearing method were 10 to 13g.

Table: 1: Cocoon characters of indoor reared tasar silkworm *Antheraea mylitta* D .on jamun

Crop	Cocoon wt.(gm)	Shell wt.(gm)	Length of shell (cm)	Width of shell (cm)	Shell Thickness (mm)	Shell ratio
First year- 2010						
June-July	10.56	1.25	3.92	2.45	0.51	11.83
Sep.- Oct	11.80	1.33	4.02	2.50	0.48	11.27
Dec.- Jan.	12.40	1.42	4.20	2.45	0.53	11.45
Second year- 2011						
June-July	10.76	1.25	4.32	2.45	0.51	11.61
Sep.- Oct	11.85	1.33	4.22	2.50	0.53	11.22
Dec.- Jan.	12.60	1.42	4.28	2.55	0.50	11.26

Table 2: Rearing performance of indoor reared tasar silkworm *Antheraea mylitta* D .on jamun

Life stages	Duration (days)	Feeding time per day	Leaf number on food plant twig	Leaf size	No of boxes/ cages	No of trays	Box/tray cleaning time	Duration of sheding Cuticle(hrs)	Humidity %	Temp. 0c
Eggs	10	------	-------	-------	----------	----------	----------	----------	75 – 80	28-30
Newly hatched larva	10 hrs	one	Tender	Whole	1	----------	----------	----------	75 – 80	28-30
1st instar	3.5	Two	Tender	Whole	1	----------	1	36	75 – 80	28-30
2nd instar	2.5	Two	Tender / June	Whole	2	-------	1	48	75 – 80	28-30
3rd instar	4	Two	June	Whole	------	2	2	48	75 – 80	28-30
4th instar	6	Two	June	Whole	------	3	3	52	75 – 80	28-30
5th instar	8-9	Two	June	Whole	----------	4	4	-------	75 – 80	28-30
pupal	25-30	----	------	------	-----	-----	------	------	75 – 80	28-30
Adult longevity	3-4	----	------	------	-----	-----	------	------	75 – 80	28-30

The shell weights of cocoon in indoor rearing method were 1.25 to 1.50 g. the shell lengths in indoor reared cocoon were 3.90 to 4.00 cm. the shell width of cocoon in indoor method were 2.45 to 2.60 cm. the shell thickness of peduncle in indoor rearing method were 0.45 to 0.52mm. The shell ratios of indoor reared method were 11.22 to 11.83 (Table.1). The effective rate of rearing (ERR), adult longevity and fecundity ranged from 75 to 80 per cent, 3 to 5 days and 175 to 210 eggs, respectively. The eggs hatchability was 95 to 100 percent and it was maximum on the first day between 8 to 10 am. Further the life cycle of insect ranged from 65 to 70 days. The results of the study like performance of tasar silk worms in (Table. 2) and the width of the different life stages are presented (Figs.1 to14).

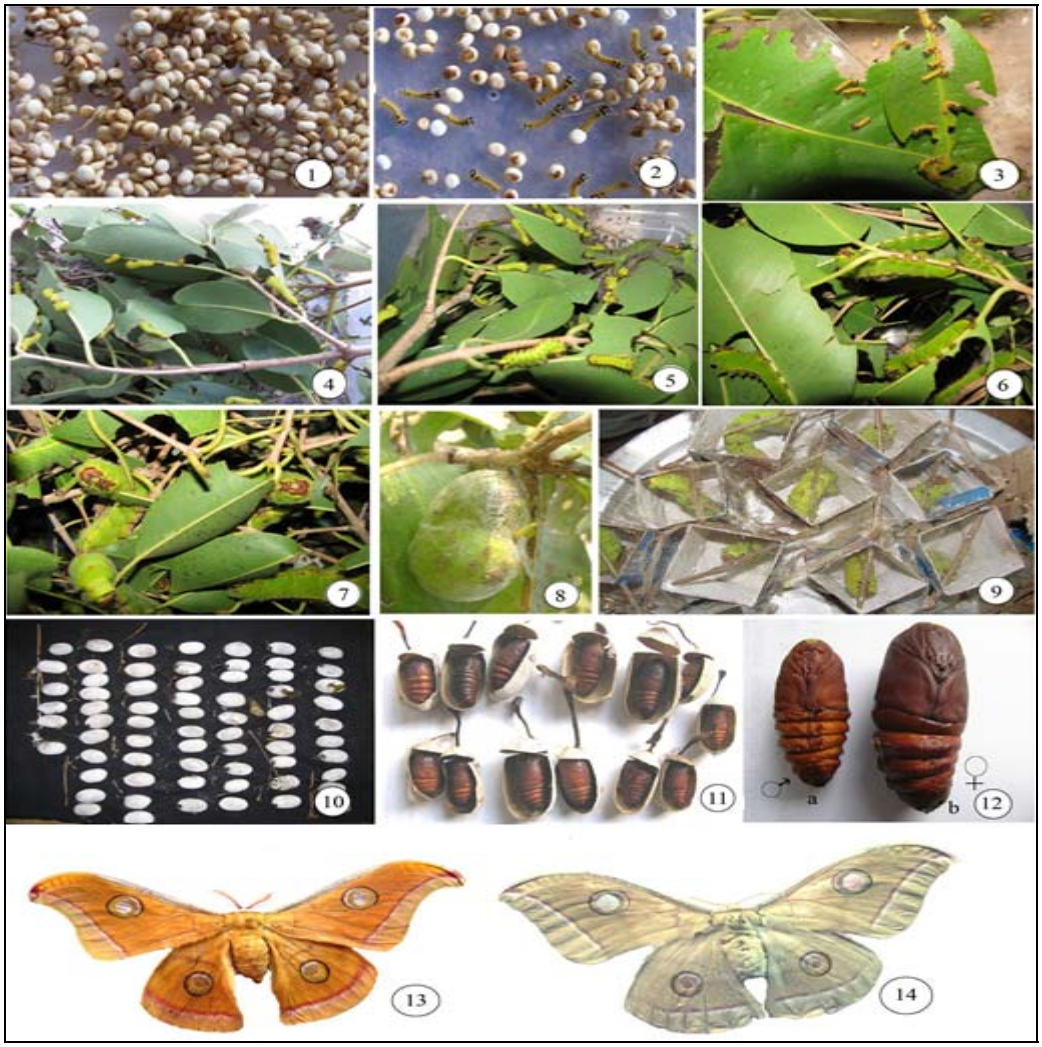

Fig 1 to 14: Rearing of *Antheraea mylitta* on Jamun crop

(1) Eggs, (2) Newly hatched larvae, (3) First instar larvae, (4) Second instar larvae, (5) Third instar larvae, (6) Fourth instar larvae, (7) Fifth instar larvae, (8, 9) Cocoon construction, (10) Cocoons, (11) Pupa with cooon, (12) a. Male pupa, b. Female pupa, (13) Male moth, (14) Female moth.

3.1. Egg

The eggs deposited in the bamboo baskets were collected washed with soap water and kept for incubation. The eggs are dorsoventrally flat with two brown lines running all along the periphery. An individual egg measured 2.2 to 2.8 mm with a mean of.2.5 mm. Hatching percent is 98 and maximum number of eggs hatched on the first day itself. The emergence of the larva from the egg commenced from morning and continued till 10 a.m.

3.2. Larva

The newly emerged first instar larva is brown in colour and fed on the left over chorion of the hatched eggs. The larvae were reared by providing tender twigs of jamun plant. The first instar measured 0.7 to 0.9 mm in length with a mean of 0.8 mm and 1.2 to 1.4 mm with an average of 1.3 mm in width at head capsule. The first instar occupied 3.5 days. The larvae that settled for the first moult were separated and kept undisturbed for moulting. From the second instar onwards, the body colour of the larvae changed to green. The second instar measured from 1.6 to 1.9 cm in length with a mean of 1.7mm, while at the head capsule, the width ranged from 1.3 to 1.5 mm with a mean of 1.4 mm. The second instar occupied 2.5 days. Immediately after the second moult, 3rd instar larvae were transferred to the twigs of Jamun.

The third instar larva measured 2.3 to 2.6 cm with a mean of 2.4 cm and the width at the head capsule ranged from 2.1 to 2.2 mm with an average of 2.2 cm. This instar lasted for 4 days. Fourth instar onwards the larvae fed voraciously and defoliated the leaves. The fourth instar ranged from 5 to 6 cm with a mean of 5.2 cm in length, while at the head capsule it measured from 4 to 5 mm in width with a range of 5.2 mm. The fourth instar lasted for 6 days. The fifth instar larvae fed for a duration ranging from 8 to 9 days. The larva measured from 9 to 11 cm with a mean of 9 cm in length, while the width at head capsule ranged from 5 to 7 mm with an

average of 6 mm. The fifth instar single larval weight varied between 25 g and 35 g with an average of 30 g. The total larval duration ranged from 30 to 32 days. The effective rate of survival was as 75-80 per cent.

3.3. Cocoon - At the end of the larval period, the ripe tasar larvae were released on the montages for cocoon construction on which cocoons were constructed. It was very interesting to note that the female cocoons measured on an average 4.2 cm and 4.5 cm, while male cocoons measured 3.8 and 4.0 in length and width respectively. The number of eggs laid by an individual female moth varied between 175 to 210 with a mean of 190 eggs per female. The adults survived for 3 to 5 days. The silkworms could be successfully reared indoors complete the life cycle. There have been no reports on the feeding habits of tasar silk worm on Jamun, a potential alternate host plant. The present finding has firmly established that the tropical tasar silkworm *A. mylitta* could be reared indoor on jamun leaves. The obstacles in traditional outdoor rearing of A. *mylitta* on naturally grown forest trees can be overcome only through adopting indoor rearing on jamun leaves. If this is done, our forest can be saved from annihilation.

A. mylitta Drury is potential wild silkmoth to be used in sericulture business. However at present rearing success of this species is about 35%. Hence there a need to standardize the rearing technique of *A.mylitta*. Secondly, *A.mylitta* is having 44 ecoraces with different rearing potential. *A.mylitta kolhapurensis* is reported for the first time from Kolhapur, India as subspecies of *A.mylitta*. Therefore, it is very interesting to know the rearing potential of this subspecies, rearing potential of this species have been tested and found 45% rearing success which is greater than previously recorded ecoraces of *A .mylitta*. The above subspecies has been published by [10] as variety of *A.mylitta*.

Ricinus communis as a potential new host plant for tropical tasar silkworm *A.mylitta.* The life-cycle duration in silkmoth ranged from 71 to 85 days [12]. There was no much variation in larval development of tasar worms reared on castor leaves compared to *T. tomentosa.* In indoor rearing, it is possible to eliminate totally the loss due to pests and predators but loss due to climatic changes is possible only to certain extent and due to diseases [5, 2, 3].

Tasar culture is a forest based industry best suited to the economy and social structure of developing countries like India [14]. Minimum investment is the most significant feature of tasar sericulture. Most of the parameters tested in indoor rearing were found to be superior to the outdoor rearing. Larval mortality during all the three crops taken was also reduced as compared to earlier.

Recently, studied indoor rearing of *A.mylitta* on a host plant *T.catappa* a tertiary food plant of wild silkmoth. The rearing success of *A.mylitta* sub sp. *kolhapurensis* on *T.catappa* under laboratory conditions (28±2 ^{0}C, 65 -70 % R.H. and 12 hrs. photoperiod) was 45% [23]. The cocoon characters were found improved as cocoon weight, shell weight, length of shell, width of shell, shell thickness and shell ratio as compare to previous reports [21]. Silkworms were adopted for indoor rearing technique by preparing no peduncle which is normally spun by the worms in outdoor rearing is, an outstanding feature of the success of indoor rearing technique [23]. In the present study, the discovery of jamun as a new and potential host of tasar silkworm, *A. mylitta* will open new vistas in tropical tasar culture and will help in boosting up of tasar silk and all parts of the jamun can be used medicinally and it has a long tradition in alternative medicine. The bark has anti-inflammatory activity and is used In India for anemia, the bark and seed for diabetes which reduce the blood sugar level quickly, the fruit for dysentery and leave's juice for gingivitis (bleeding gums).

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