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Ziziphus jujuba - a potential host of tropical Tasar silkworm *Antheraea mylitta* - Kolhapurensis (Kavane) (Lepidoptera-Saturniidae) under Western Maharashtra condition

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ABSTRACT

The rearing of tasar silkworm, *Antheraea mylitta* kolhapurensis on the leaves of *Ziziphus jujuba* (Ber) reared under indoor rearing condition for the first time in India. It is a small deciduous tree or shrub reaching a height of 5–12 mt. (16–39 ft), usually with thorny branches. The leaves are shiny-green, ovate-acute, 2– 6.5 cm. (0.79–2.76 in) wide and 1–3 cm (0.39–1.18 in) broad, with three conspicuous veins at the base, and a finely toothed margin. And it belongs to the *Rhamnaceae* plant family. It was observed that the ber is a potential host of tropical tasar silkworm. The growth parameters and cocoon characters of the tasar silkworm reared on ber leaves were normal. The tasar silkworm successfully lasted its life cycle ranged from 55 to 65 days. The effective rate of rearing, weight of pre-spinning larvae, cocoon, shell and pupae ranged from 20 to 30 per cent, 20 to 30 g, 8 to 10 g, 0.90 to 1.10g, 8 to 9 g, respectively. Parameters such as length of cocoon shell, peduncle, width of shell, peduncle, shell thickness etc. the fecundity ranged from 135 to 140 eggs. The finding of ber as a potential host for tropical tasar silkworm has developed for raw silk production.

Keywords: Indoor rearing, Tasar silkworm, *Antheraea mylitta kolhapurensis*, Ziziphus *jujuba (*Ber) .

INTRODUCTION

Tropical tasar silkworm *Antheraea mylitta* kolhapurensis Bivoltine is known to infest ber crop in nature. The tasar silkworm *A. mylitta* Drury also called "vanya silkworm" is one of the commercially exploited silkworms reared outdoor. 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 (Jolly, 1975). Indoor rearing of tasar silkworm *A. mylitta* on *Terminalia catappa* Cooke leaves used for its food and rearing potential 40 percent reported (Kavane & Sathe, 2007; Kavane, 2010; Kavane & Sathe 2011). Several workers have earlier reported positive response of *A. mylitta* different ecoraces for indoor rearing.

However, till no serious effort being made to study from chawki stage to the cocoon stage (Jayaprakash, 1993). The plant *Ziziphus jujuba* is also known as Ber, jujube. The *Ziziphus jujube* Pers. mostly found almost all parts of areas. The leaves used for hypoglycemic effects, reduction of sweetness judgements, as diuretic, emollient, expectorant, to promote hair growth, anticancer, sedative, blood purifier and in treatment of diarrhoea. Therefore, an attempt has been made to rear the insect from first instar to the last instar and allow for cocoon and adult formation on host food Ber.

Materials and Methods

Cocoons were collected from host plants Ber*(Z. jujuba)* from different parts of 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

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photoperiod . Inside a moth cage made of nylon. For this study, the indoor rearing methodology developed for *A. mylitta* was followed (Kavane & Sathe, 2007, 2009, 2010, 2011, Kavane, 2010, 2014).

Newly hatched larvae were released on the leaves of the host plants Ber *(Z. jujuba)* with the help of soft camel hairbrush. 8-10 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 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 to 3rd instars for used boxes were then washed, disinfected and dried for re-use ,Kavane (2010).

Rearing trays of size (3'x 2.5'x 6'in length x width x height respectively) were used for rearing of 4th and 5th instar larvae. A small twig having 12 to 15 leaves was used as leaf diet 25 – 30 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 were 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 stick 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 (100) was used for confirming results. The rearing was conducted for two successive years i.e. June to December 2013-2015, two crops given in each year.

Results and Discussion

It was observed that there was less mortality of I st instar *A. mylitta* kolhapurensis worms when fed with tender Ber leaves. 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* kolhapurensis on Ber under indoor rearing conditions (28 ±2 ^{0}C and RH of 75 ± 5% and 12 hrs photoperiod) was 25 %. The moths mated successfully laid fertilized eggs in the mud pot and covered with nylon mesh in rearing house. The incubation period, larval and pupal duration ranged from 10 days, 28 to 32 days, 15 to 20 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, 4.5 to 5.5, and 6.5 to7.5 days, respectively. The weight of matured tasar silkworm Vth instar was 20 to 30 g and measured 6.5 to 7.5 cm in length, 2.9 to 3.2 cm in circum. The weight of cocoon including pupa in indoor rearing method were 8 to 9 g. The shell weights of cocoon in indoor rearing method were 0.95 to 1.10 g., the shell lengths in indoor reared cocoon were 3.40 to 3.90 cm, the shell width of cocoon in indoor method were 2.10 to 2.30 cm .the shell thickness of peduncle in indoor rearing method were 0.40 to 0.45 mm. The shell ratios of indoor reared method were 11.24 to 13.40 (Table.1).

The effective rate of rearing (ERR), adult longevity and fecundity ranged from 20 to 30 per cent, 3 to 4 days and 135 to 145 eggs, respectively. The eggs hatchability was 95 to 100 percent and it was maximum on first day between 8 to 10 am. Further the life cycle of insect ranged from 55 to 65 days. The results of the study like performance of tasar silk worms in (Table. 2) and the different life stages are presented (Figs.1 to 9).

Egg:

The eggs are dorsoventrally flat with two brown lines running all along the periphery. An individual egg measured 1.9 to 2.3 mm with a mean of.2.1 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.

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

Table-1. Cocoon characters of indoor reared tasar silkworm *Antheraea mylitta* kolhapurensis on Ber

Crop	Cocoon wt.(gm)	Shell wt.(gm)	Length of shell (cm)	Width of shell (cm)	Shell Thickness (mm)	Shell ratio
First year- 2014						
June-July	8.45	0.95	3.40	2.10	0.48	11.24
Dec.- Jan.	9.15	1.10	3.90	2.15	0.45	12.02
Second year- 2015						
June-July	8.64	0.94	3.26	2.10	0.46	10.87
Dec.- Jan.	9.10	1.22	3.33	2.25	0.50	13.40

Table-2. Rearing performance of indoor reared Tasar silkworm *Antheraea mylitta* kolhapurensis on Ber

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	31	75 – 80	28-30
2nd instar	2.5	Two	Tender / June	Whole	2	-------	1	43	75 – 80	28-30
3rd instar	4	Two	June	Whole	3	----------	2	45	75 – 80	28-30
4th instar	4.5	Two	June	Whole	------	3	3	49	75 – 80	28-30
5th instar	6-7	Two	June	Whole	----------	4	4	-------	75 – 80	28-30
pupal	15-20	----	------	------	-----	-----	------	------	75 – 80	28-30
Adult longevity	3-4	----	------	------	-----	-----	------	------	75 – 80	28-30

twigs of Ber 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 1.2 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 1.8 cm in length with a mean of 1.7mm, while at the head capsule the width ranged from 1.3 to 1.4 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 Ber.

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 4 to 5 cm with a mean of 4.5 cm in length, while at the head capsule it measured from 4 to 5 mm in width with a range of 5.1 mm. The fourth instar lasted for 5-6 days. The fifth instar larvae fed for a duration ranging from 6.5 to 7.5 days. The larva measured from 6 to 7.5 cm with a mean of 6.7 cm in length, while the width at head capsule ranged from 5 to 6.5mm with an average of 5.8 mm. The fifth instar single larval weight varied between 20 g and 30 g with an average of 25 g. The total larval duration ranged from 30 to 32 days. The effective rate of survival was as 25-30 per cent. 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 4.1 cm and 4.4 cm, while male cocoons measured 3.2 and 3.9 in length and width respectively. The number of eggs laid by an individual female moth varied between 135 to 140 with a mean of 140 eggs per female. The adults survived for 3 to 4 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 Ber, a potential alternate host plant. The present finding has firmly established that the tropical tasar silkworm *A. mylitta kolhapurensis* could be reared indoor on Ber leaves. The obstacles in traditional outdoor rearing of A. *mylitta* on naturally grown on trees can be overcome only through adopting indoor rearing on Ber leaves.

A. mylitta kolhapurensis is potential wild silkmoth to be used in sericulture business. However at present rearing success of this species is about 30 %. Hence there is 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 on badam and found 45% rearing success which is greater than previously

Figures 1-9. Rearing of *Antheraea mylitta* Kolhapurensis feed on Ber. 1-Newly hatched larva; 2-first instar; 3-second instar; 4-third instar; 5-fourth instar; 6-fourth moult; 7&8-fifth instar; 9-coccons with twig

recorded ecoraces of *A .mylitta*. The above subspecies has been published by Kavane & Sathe (2009) as variety of *A.mylitta.*

Shamitha (2007) attempted total indoor rearing of tasar silkworm *A. mylitta.* Tasar culture is a forest based industry best suited to the economy and social structure of developing countries like India.

Recently, Kavane and Sathe (2007) 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%.

According to Kavane & Sathe (2007, 2009, 2010, 2011) silkworms were adopted for indoor rearing technique by preparing no peduncle which is normally spun by the worms in outdoor rearing is, outstanding feature of the success of indoor rearing technique. In the present study, the Ber potential host of tasar silkworm, *A. mylitta kolhapurensis* will open new vistas in tropical tasar culture and will help in boosting up of tasar silk and all parts of the Ber can be used medicinally and it has a long tradition in alternative medicine (Herbert L. et.al.1975). The leaves used for hypoglycemic effects, reduction of sweetness judgements, as diuretic, emollient, expectorant, to promote hair growth, anticancer, sedative, blood purifier and in treatment of diarrhoea .

Conflict of Interests

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