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Rearing technique for a wild silk worm *Actias selene hubner* (Lepidoptera: Saturniidae)

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ABSTRACT

Actias selene Hubner (Lepidoptera: Saturniidae) is wild silk worm of India. It has durable silk. Therefore, its conservation and exploitation in silk industry is integral part of sericulture. However, silk production technology of A. selene is not developed so far. Hence, in the present paper preliminary rearing technique of A. selene is given. Cocoons were formed within 45 days. Cocoon weight, shell weight, shell length, shell width and shell thickness were 7.42 g, 0.93 g, 4.2 cm, 2.2 cm and 0.18 mm respectively, while shell ratio calculated was 12.53%. The rearing success of A. selene was 25% on Terminalia tomentosa W. & A. The mated females laid 105 eggs and produced 22 offspring's with an average sex ratio (m: f) 1: 0.75.

Key words: Rearing technique, Actias selene, wild silkworm, India.

INTRODUCTION

The Indian wild silks like Tasar *Antheraea mylitta* Drury and Muga *Antheraea assamensis* W. are well known in the world as far as rearing technology is concern. However, satisfactory rearing technology with high success of survivals of silk worms has not developed for *Actias selene* Hubner in India. *A. selene* produces durable and brownish silk. In the environment of forests and Western Ghats of Maharashtra the worms of *A. selene* are widely scattered (Kavane & Sathe, 2011). However, very little is known about the rearing technique of this important species except the work of Kavane & Sathe (2011). Review of literature indicates that Hampson, 1892; Watson 1911; Lefroy & Ghosh, 1912; Pottar, 1941; Jolly, 1972; Barlow, 1982; Nassig & Peigler, 1984; Crotes, 1989; Islam, 1990; Thangavellu *et al.* 1991; Akai, 1998; Rajadurai & Thangavellu, 1998; Saikia & Handique, 1998; Sathe & Jadhav, 2001; Sathe, 2007; Kavane & Sathe 2008, 2014; Sathe *et al.*, 2008; Jadhav *et al.* 2014; Sathe & Desai, 2014; Sathe & Chougale,2014; Sathe & Kavane, 2014; etc. attempted the Tasar silk worms with respect to diversity and rearing.

MATERIALS AND METHODS

The basic plan of methodology adopted for rearing of wild silkworm *A. selene* is the same as given by Kavane & Sathe (2011). Other details of rearing are given in table 1 & 2. Rearing of *A. selene* larvae was made on the host plants *Terminalia tomentosa* W. & A. *Terminalia arjuna* W. & A. and *Terminalia catappa* L.

Cocoon Characterization

Following characters were taken into account for assessment of rearing potential of wild silkworm species.

i) Single cocoon weight

Sr. No.	Food plant	Cocoon wt. (g)	Shell wt. (g)	Length of Shell (cm)	Width of Shell (cm)	Shell thickness (mm)	Shell ratio (per cent)
1.	*T. catappa*	7.42	0.93	4.2	2.2	0.18	12.53
2.	*T. arjuna*	8.05	1.20	3.9	2.1	0.19	14.90
3.	*T. tomantosa*	8.35	1.41	3.8	2.1	0.21	16.88

Table-1 Cocoon characterization of *A.selene*

Instar of worm	Duration (Days)	Feeding time per day	Feeding time total	Feeding dose total (kg)	Leaf proportion (g)	Leaf number of food plant twig	Leaf size	No. of Boxes	No. of trays	Box/ Tray cleaning time	Duration of shading cuticle(hr)	Humidity %	Temp. ^{0}C	Bed Size Sq.ft
1st	4.5	1	3	1-1.5	40-50	2-3 (Top)	Whole	1	-	2	24	75	26-28	1
2nd	5	2	6	2-2.5	50-60	3-4 (Top)	Whole	1	-	2	48	75	26-28	3
3rd	6	2	14	3-4	50-60	Medium/ June	Whole	-	1	3	72	80	26-28	6
4th	6	2	14	5.5-6	65-75	Medium/ June	Whole	-	1	Once every morning	72	75-80	26-28	12
5th	10	2	22	6.5-7	75-85	Medium/ June	Whole	-	1	Once every morning	-	75-80	26-28	18

Table 2 : Requirements for rearing one DFL for *A. selene* silk worms*. *One DFL contain 100 eggs of *A. selene silkworm,* food plant- *T. tomentosa.***

The average cocoon weight in grams of 10 cocoons were taken at random from each replicate on sixth day of spinning was considered as the cocoon weight.

ii) Single cocoon shell weight

The cocoon shell weight of 10 cocoons was used for calculating the average shell weight, which was expressed in grams.

iii) Determination of the size of the cocoon

Length and width of the cocoon shell was determined with vernier calipers. The width of the cocoon was measured in different areas such as head, middle and tail regions and calculated by using formula :

Total length / width = main scale reading + vernier coincidence x least count.

iv) Determination of the thickness of the cocoon shell

The thickness of the cocoon shell was determined with the help of the screw gauge. The cocoon was cut into small pieces in different regions like head, tail, side-1 (right side) and side - 2 (left side) to measure its thickness and calculations were made by using the following formula :

Thickness of cocoon = pitch scale reading + head scale reading x least count.

v) Shell ratio =

Wt. of shell / Wt. of cocoon x 100

RESULTS

The results recorded in Table 1 and 2 and figures 1 to 4 indicate that the cocoon formation took place within 45 days (average 40 days). Cocoon weight, shell weight, length of shell, width of shell and shell thickness were 7.42 g, 0.93 g, 4.2 cm, 2.2 cm and 0.18 mm on the food plant *T. catappa*, they were 8.05g, 1.20g, 3.9cm, 2.1cm and 0.19mm on the food plant *T. arjuna* while, on *T. tomantosa* they were 8.35g, 1.41g, 3.8cm, 2.1cm and 0.21mm respectively. The shell ratio of cocoons on above plants was 12.53 %, 14.90% and 16.88% respectively. The rearing success of *A. selene* silkworms on food plants *T. tomantosa*, *T. arjuna* and *T. catappa* was 25%, 5% and 2% respectively under laboratory conditions (27 ± 1ºC, 75-80% RH and 18hr photoperiod).

Figure.1 *A. selene*: Adult.

Figure.2 *A. selene*: Eggs and 1st instars

Figure.3 *A. selene*: 5th instar

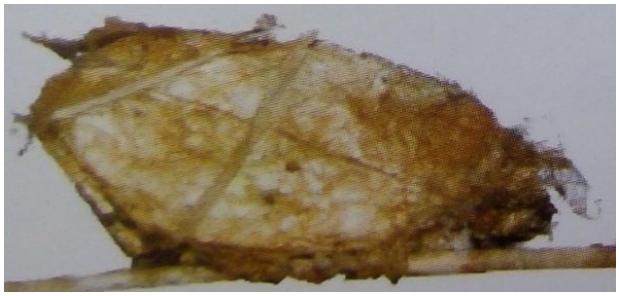

Figure.4 *A. selene*: Cocoon

DISCUSSION

Cotes (1891-93) and Barlow (1982) studied the host plants of *A. selene* from northen part of India. They reported that, *A. selene* was found feeding on *Zanthoxylum acanthopodium* D. & C., *Z. alatum* Roxb (Rutaceae), *Cedrela paniculata* (Meliaceae), *Coriana nepalensis* Wall. (Coriariaceae), wild cherry prunus, wild pear pyrus (both Rosaceae), walnut (Jugandaceae) and other fruit trees in northern India. According to Nassig and Peigler (1984) some members of Anacardiaceae were good host plants for *A. selene.* Potter (1941) reported *Heptapleurum octophyllum* B. &H. (Araliaceae) as a host plant for *A. selene* from Hong kong. Chen-Shuren *et al*. (1997) observed that larvae of *A. selene* caused considerable damage to the plant *Cornus officinalis* Sieh in China at Zucc by feeding on leaves. They further noted that the pupae of *A. selene* were diapaused in summer season. The moth exhibited trivoltine nature of life cycle pattern which synchronized with the meterological conditions of the region. In the present study, in Kolhapur region *A. selene* completed three generations although the region showed high rain fall, 1200 mm and relative humidity 80-88%.

Raja durai et al. (1988) reported that *A. selene* was associated with mixed forest plants namely, *T, arjuna, T. tomantosa* and *Ziziphus mauritiana* Lamark. They studied the life cycle of *A. selene* wherein incubation period of eggs was 9 days, larval period 31 days and pupal 18 days. The total period for completion of life cycle was 58 days while, in the present study the life cycle from egg to adult was completed within 49-50 days only which was considerably shorter then the previously reported (Rajadurai et al., 1988). Biology of *A. selene* has also been studied by Kavane & Sathe (2011) on *T, arjuna, T. tomantosa* and *T. catappa* under laboratory conditions (25-30^{0}C, 70-80% RH, 18hr photoperiod). The authors could develop the insects for three generations in the laboratory. According to Rajadurai et al. (1998) the adult male survived for 3 to 4 days and females 4 to 6 days. More or less same situation was noted in the present study.

Rajadurai & Thangavellu (1998) reported that the life cycle of *A. selene* and reported that *A. selene* was distributed widely all along the mixed forests plants such *T. arjuna*, *T. tomentosa* and *Z. mauritiana*. The incubation period of egg was 9 days, the larval period was 31 days and the pupal duration was 18 days. The adult males survived for 3-4 days and females 4-6 days. The total period for completion of life cycle was 58 days.

Lefroy and Ghosh (1912) reported the commercial importance of Saturniids, the diversified wild silk moths as silk producing individuals of the World. He reported that the wild saturniid Moon moth *A. selene* was geographically distributed in tropical and deciduous forests while, Cotes (1889) recorded *A. selene* from Missorie and Sikkim parts of India.

Attacus atlas L. was found feeding on an unusual variety of food plant, the sole heather plant *Moynalaxi flora*, family Rubiaceae in the forests (Islam, 1990). The cocoon produced by this silkworm was somewhat light brown and similar to Eri cocoon in silk nature and useful for commercial silk production.

Saikia and Handique (1998) studied the life cycle of *A. atlas* by providing main food plant *M. flora* under which the incubation period of eggs was 10 days, the larval period was 28 days and the pupal duration was 28 days. The adult male survived for 2-3 days and female 4-6 days. Hampson (1892) reported tubercular arrangement in the larvae of *A. atlas*.

Thangavellu and Peigler (1984) reported over 100 plant species belonging to 90 genera of 48 families as host plants for *Attacus* spp. However, *A. atlas* it occurred at low levels on *Bruguiera gymnorhiza* Lamk. (Rhizophoraceae). The biology of *A. atlas* was recently reported by Kavane & Sathe (2011) completing its life cycle from egg to adult within 64.5 days on Angeer *Ficus carica* L. under laboratory conditions 30 ± 1^0C, 80% R.H. & 12 hr. photo period.

The biology of A. atlas was recently reported by Kavane & Sathe (2011) and Sathe & Kavane (2014) completing its life cycle from egg to adult within 64.5 days on *F. carica* under laboratory conditions 30±1ºC, 80% RH. & 12 hr photoperiod. In the present study attempts have been made to establish rearing technique for *A. selene* on various host plants like *T, arjuna, T. tomantosa* and *T. catappa.*

Kavane and Sathe (2008) indicated that the rearing success of *A. mylitta* on *T. catappa* under laboratory conditions (24 ± 1^0C, 65-70% R.H. & 14 hr. photo period) was 45% and also recorded the good sign of adaptation of silk worms for indoor rearing by not forming peduncle. Similarly, attempts have been made to standardize the rearing technique of tasar silkworm *A. mylitta* by several workers (Jolly 1972; Sathe & Jadhav, 2001).

Very recently, Jadhav *et. al.* (2014) studied the performance of tasar silkworm *A. mylitta* on different food plants from Kolhapur district of Maharashtra. They reported that *A. mylitta* produced best quality and quantity cocoons when their larvae were fed with leaves of *T. tomentosa* in autumn season as compared to other host plants. The performance of rearing of *A. mylitta* was better on the leaves of *T. arjuna* than *T. cattapa* and *Ziziphus jujuba* L. The life cycle of *A. mylitta* was lengthy in autumn and best compared to rest of the seasons.

Reproduction in insects is very closely related to nutritional factor, the qualitative and quantitative aspects of that have an impact not only on fecundity but also on the rate of growth and development. The silkworm larvae are known to be continuous feeders, hence the deficiency in the amount of food required to reach its full potential will be manifested in various ways and degrees (Waldbauer, 1968). In the present study, *A. selene* have received different food plants viz., *T. tomentosa, T. arjuna* and *T. cattapa.* Among the above three host plants, *T. arjuna* found to be the superior food for the silk worm *A. selene*.

Protection of silk worms from natural enemies became serious problem for both Tasar and Mulberry sericulture (Sathe & Desai, 2014; Sathe & Chougale, 2014; Sathe, 2014). *Xanthopimpla* spp attacked *A. selene* from Kolhapur region. There control is essential part of Tasar sericulture. It is a crystal clear that survival rate of worms in the present study was not more than 25 % therefore, there is a scope to improve the present rearing technique of *A. selene* in future.

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