

**MASS MULTIPLICATION OF PUPAL PARASITOID,  
*NESOLYNX THYMUS* (GIRAULT) (HYM.: EULOPHIDAE)  
FOR THE MANAGEMENT OF UZI FLY, (DIP.: TACHINIDAE)  
*EXORISTA BOMBYCIS* (LOUIS) IN MUGA SILKWORM  
*ANTHARAEA ASSAMENSIS* HELFER (LEP.: SATURNIIDAE)**

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[**Eswara Reddy, S. G. & Rajan, R. K.** 2011. Mass multiplication of pupal parasitoid, *Nesolynx thymus* (Girault) (Hym.: Eulophidae) for the management of uzi fly, (Dip.: Tachinidae) *Exorista bombycis* (Louis) in muga silkworm *Antheraea Assamensis* Helfer (Lep.: Saturniidae). Munis Entomology & Zoology, 6 (2): 882-885]

**ABSTRACT:** Experiments were conducted in the Bio-Control Laboratory, Central Muga Eri Research and Training Institute, Lahdoigarh, Jorhat (Assam) during September-December 2010 to standardize the mass multiplication techniques for pupal parasitoid, *Nesolynx thymus* (Hymenoptera:Eulophidae) on the pupae of housefly, *Musca domestica* (Diptera:Muscidae) in the laboratory to release in the muga silkworm rearing field for the management of Uzi fly, *Exorista bombycis* (Diptera:Muscidae). Results indicates that an initial establishment cost of rupees 0.74 lakh and consumables cost of rupees 0.197 lakh is required for the production of 10 lakh *N. thymus* (1000 pouches) adults for covering 20,000 disease free layings (DFLs) of muga silk worm. It is also indicates that a benefit of rupees 2.03 was obtained at every rupee spent. The collected housefly pupae parasitized by *N. thymus* were kept in a container for 10-12 days in summer and 20-25 days in winter for emergence then 50% honey was provided for *N. thymus* immediately after emergence. The parasitoids were released in the field during evening hours after 8-10 hrs of mating. For 100 Disease free layings (DFLs) of muga silkworm larvae, 60,000 numbers (6 pouches) of parasitoids to be released in the rearing field for six releases @ 10000/release at an interval of 5-7 days, once in 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> & 5<sup>th</sup> instar, spinning and grainage stage. The standard protocol for mass multiplication of parasitoid on house fly pupae and its economics, benefit cost ratio (BCR) is discussed.

**KEY WORDS:** Muga culture, Outdoor rearing, Disease Free Layings, Mass production, Benefit cost ratio.

Muga silkworm, *Antheraea assamensis* Helfer (Lepidoptera: Saturniidae) is semi domesticated, polyphagous, multivoltine and endemic to Assam, yields golden yellow silk. The present production of raw silk in Assam is 117 million tones accounting to 0.65% of raw silk produced in the country, while rest of the production contributed by other North-Eastern states (Anon, 2009). The muga silkworm is reared in 5-6 seasons in a year. The *Jethua* (April-May) & *Kotia* (Oct.-Nov.) rearing are commercial crops, *Chotua* (Feb.-Mar.) & *Bhodia* (Aug.-Sept.) as seed and *Jarua* (Dec.-Jan.) & *Aherua* (June-July) as pre-seed crops. Muga silkworm is attacked by number of parasitoids (*Apanteles* sp., *Exorista bombycis*) and predators (ants, wasps, birds etc.). Among these *E. bombycis* is one of the serious endo-parasitoid particularly during *Jarua* (Dec.-Jan.) and *Chotua* (Feb.-Mar.) seed crops causing 20-90% loss in winter & post winter (Dec.-Mar.) (Anon, 2007) and 50-70% cocoon rejection during Feb.-March (Anon, 1996).

Single female *E. bombycis* prefers to lay eggs directly at inter segmental region of the larval body. After hatching, the maggots penetrates into the larval body and starts feeding on inner tissues/fat bodies then maggots comes out from the body

and pupates in the soil. The silkworm parasitized by Uzi fly in early instars are killed before attaining spinning stage, while those parasitized in the late 4<sup>th</sup> & 5<sup>th</sup> instars spin cocoons of weak built and from such cocoons Uzi maggots emerge by piercing, thus rendering cocoons unfit for reeling and reduces the market value. Presence of egg(s) or black scar on the body of the silkworm larvae and maggot emergence hole in the cocoons indicates Uzi infestation (Narayanaswamy & Devaiah, 1998). As per the recent survey results indicates that, maximum infestation of Uzi fly was in 5<sup>th</sup> instar larvae (43.0%) and at harvesting of cocoons (35.0%) during *Chotua* crop (Mar.-Apr.2010) followed by *Jarua* crop, Dec. 2009-Jan. 2010 (19.0% infestation at larval stage & 27.50% at harvesting stage) reported in Upper Assam (Eswara Reddy, 2010a,b).

Reports indicate that, the parasitoid *N. thymus* was effective in reducing the Uzi fly infestation in mulberry silkworm, *Bombyx mori* L. (Lepidoptera: Bombycidae) under indoor rearing conditions but it is not evaluated for the management of Uzi fly in muga silkworm which is reared under out door conditions on som (*Persea bombycina*) and soalu (*Litsea monopetala*) plantations. Keeping in view that, this study was under taken to standardize the commercial mass production of the *N. thymus* in the laboratory on house fly pupae for the management of Uzi fly in muga silkworm under Assam conditions.

## MATERIALS AND METHODS

The laboratory host of housefly, *Musca domestica* (Diptera: Muscidae) was utilized for the mass production of *Nesolynx thymus* (Hymenoptera: Eulophidae) in the laboratory conditions (temperature at 22-25°C and humidity 60-65%) for field release to manage *E. bombycis* in the muga culture. The standardized protocol for the above was given below.

### **Steps involved in the multiplication of housefly for mass production of *N. thymus* in the laboratory:**

1. Prepare one basin of diet for 2.0 ml of housefly eggs by soaking 400-600 grams of dry cow dung cake/powder, 25 grams of dried yeast in 4 liters of water for 12 hrs for fermentation then add 1.20 kg of wheat bran and mix. This diet will be used as a feed for housefly maggots and for attraction of fly to lay eggs. The quantity of the diet required will be varying as per the availability of housefly eggs.
2. To maintain housefly culture initially in the laboratory, keep the little quantity of diet (100-200g) in a Petri dish covered with white cloth then put it out side/in a corridor for 4-5 hours or inside the rearing cage containing houseflies for egg laying on the diet.
3. Collect the eggs during after noon (2-3 pm) and sprinkle on the soaked wheat bran.
4. In the next day, transfer/sprinkle the newly hatched housefly maggots into the round basin containing diet and maggots will feed the diet for 6-7 days.
5. Separate and collect the housefly maggots on 7<sup>th</sup> day in summer and 9<sup>th</sup> day in winter by using mosquito net then sprinkle saw dust for pupation.
6. Collect the pupae in 2-3 days after pupation using wire mesh by sieving for parasitization.
7. Keep required quantity of housefly pupae in a rearing cage for further multiplication

8. Keep milk powder and sugar (1:1 ratio) in one Petri dish (container) and cotton swab dipped in water in another Petri dish as feed for adult houseflies in the rearing cage.
9. Keep the diets in a rearing cage 6-7 days after emergence to attract houseflies for egg laying.

**Steps involved in the parasitization of housefly pupae by using adult female of *N. thymus* for commercial production:**

1. After emergence of parasitoid, *N. thymus* provide feed containing honey and water at the ratio of 1:1 dipped in a cotton swab/thick plastic strip.
2. Allow the emerged adults of *N. thymus* for 8-10 hours for mating.
3. Transfer the 2-3 days old cleaned housefly pupae to the container containing *N. thymus* and allow to parasitize for four days at parasitoid host ratio of 1:20.
4. Collect the housefly pupae after parasitization and keep in a container for 10-12 days in summer and 20-25 days in winter for emergence of *N. thymus* adults.
5. Collect the houseflies if any emerged from un-parasitized pupae on 12th day.
6. Collect the parasitized pupae and pack in a perforated boxes and supply to the farmers
7. Provide honey to parasitoids immediately after emergence and allow 8-10 hours for mating then release in the field during evening hours.

**Note:** Maintain optimum temperature (20-25°C) and humidity (60-70%) in the laboratory for mass production of parasitoids/house fly cultures in the laboratory.

## RESULTS AND DISCUSSION

The experimental results on recommendation, release schedule and economics of mass production of *N. thymus* is presented in the Table 1 & 2.

**Recommendation of parasitoid, *N. thymus* for 100 disease free layings (DFL's):**

The collected housefly pupae were kept in a container for 10-12 days in summer and 20-25 days in winter for emergence then 50% honey was provided for *N. thymus* immediately after emergence. The parasitoids will be released in the field during evening hours after 8-10 hrs of mating. For 100 Disease free layings (DFLs) of muga silkworm larvae, 60,000 numbers (6 pouches) of parasitoids will be released in the rearing field for six releases @ 10000/release at an interval of 5-7 days, once in 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> & 5<sup>th</sup> instar, spinning and grainage stage. The parasitoid to be released in the centre of the field by opening the lid of the container, the parasitoids was comes out in search of Uzi fly pupae for parasitization (Table 1).

**Economic indicators for mass production of *N. thymus* in the laboratory:**

Standard protocol was developed for mass production of *N. thymus* on *M. domestica* pupae under laboratory conditions by maintaining optimum temperature and relative humidity. Results indicates that, initial establishment cost of rupees 0.74 lakh and consumables cost of rupees 0.197 lakh is required for production of 10 lakh *N. thymus* (1000 pouches) adults for covering 20,000

disease free layings (DFLs) of muga silk worm. It is also indicates that a benefit of rupees 2.03 was obtained at every rupee spent (Table 2).

### ACKNOWLEDGEMENTS

Author is highly thankful to the Director, Central Muga Eri Research and Training Institute, Central Silk Board, Jorhat, Assam for providing facilities to carryout the experiments.

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Table 1. Recommendations and release schedule of parasitoids per 100 DFL's.

Total number of parasitoids to be released	:	60,000 No. (6 pouches)
Number of parasitoids/release	:	10,000 No. (1 pouch)
Number of releases	:	6
Interval of release	:	5-7 days
<b>When to release?</b>		
Larval stage	:	Once in 2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> & 5 <sup>th</sup> instar
Spinning stage	:	Once
Grainage	:	Once
<b>How to release?</b>		
	:	Open the lid/muslin cloth covered with container containing parasitoids and keep in the centre of rearing field

Table 2. Economics for mass production/unit/month.

Particulars	Amount (Rs.)
A. Initial Establishment cost	Rs. 74,000.00
B. Depreciation cost @ 5%	Rs. 3,700.00
<b>Monthly expenditure</b>	
C. Consumables	Rs. 13,500.00
D. Building rent	Rs. 2,500.00
Total production cost/unit/month (B+C+D)	Rs.19,700.00
Production capacity/month	1000 pouches
Selling price/pouch	Rs. 40.00
Sale proceed/unit/month (Rs.40 x 1000)	Rs. 40,000.00
Benefit Cost Ratio (BCR)	Rs. 2.03:1.0