IMPROVEMENT OF REARING PERFORMANCE IN MUGA SILKWORM *ANTHERAEA ASSAMENSIS* WITH HORMONE TREATMENT

Palash Dutta*, P. Dutta, A. K. Rai*** and K. Neog***

* Central Muga Eri Research & Training Institute,Lahdoigarh, Jorhat-785700, Assam, INDIA. E-mail: pdutta_1@yahoo.com
** Regional Medical Research Centre (ICMR), Lahoal,Dibrugarh-786001, Assam, INDIA.
*** Department of Life Sciences, Dibrugarh University, Dibrugarh-786004, Assam, INDIA.

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ABSTRACT: Reproductive efficiency of economic insects and its rearing performances are greatly affected by hormonal activities together with the environmental and cultural practices. Two different hormones were selected for tropical application on muga silkworm (*Antheraea assamensis* Helfer) to study their effect on the overall rearing performances. JH-III (Juvenile hormone) in three different concentrations and 20-Hydroxyecdysone *i.e.* 5, 10 and 15 μg/g body weight (w/w) were applied exogenously on head region of 5th instars 1st day larvae of muga silkworm. Larvae treated with higher concentration of 20-hydroxyecdysone (15 μg) and JH-III (10 μg) were significantly superior in terms of cocoon formation (86.2±3% and 78.4±2.97%), cocoon weight (6.174±0.34gm and 5.616±0.07gm), pupal weight (5.888±0.10gm and 5.078±0.04gm), shell weight (0.576±0.005gm and 0.532±0.01gm) compared to that of control. Similarly, the length of ovary (10.26±0.22 cm and 9.38±0.12cm) and fecundity (179.3±8.35 nos and 163.6±2.97 nos) in the treated larvae was also higher. Application of JH-III has resulted in the prolongation of larval period (8.0±0.44days) however, treatment with 20-hydroxyecdysone has shortened the larval period (5.8±0.37days) with higher silk ratio (8.346 ±0.29 %). Thus, JH-III and 20-hydroxyecdysone can successfully be applied for ovarian development which in turn can exhibit reproductive efficiency of muga silkworm.

KEY WORDS: Rearing, hormone, muga, silkworm.

Sericulture is an income generating agro-enterprise in the north-east region to alleviate poverty, through increasing rural women employment and their income, and thus, has been given due priority by Agriculture Perspective Plan (APP, 1995). In muga culture, the seed production is the most critical aspect that is considered as bottleneck in augmenting muga production. Large-scale production of muga silk is a daunting task due to insufficient yield of seed. The fecundity in muga silkworm is very poor for commercial rearing. Although the silkworm has the potential to lay a good number of eggs (250-280) realized fecundity (120-150) is comparatively poor even during the favorable seasons of *Jethua* and *Kotia* compared to eri (440-470) and mulberry (450-550).For reason unknown retention of eggs always occurs in this insect. Thus, the physiology of the insect itself can be attributed as the main factor that leads to the drawback in muga industry. There is a strong possibility that the neuroendocrine factor might come into play in controlling the physiology of the insect's reproductive cycle. Works on endocrine control of reproduction by different workers in different insects have given insight that interplay of juvenile hormones and ecdysteroids are essential during vitellogenesis, oocyte maturation and ovarian development.

The shiny golden silk producer muga silkworm (*Anthereae assamensis* Helfer) is a multivoltine and polyphagous lepidopteron insect highly endemic to North Eastern part of India, especially in Assam (Choudhury, 1970; Subba Rao, 1983). The silkworm is being reared six crop in a year including two crops each of pre seed, seed and commercial. Chotua and Bhodia are seed crops, Jethua and Kotia are commercial crops and while Jarua and Aherua are pre seed crops (Thangavalu et al., 1988). Due to it's out door nature of rearing, the silkworm is exposed to various environmental factors such as temperature, humidity, rainfall etc. which eventually affect on reproductive behavior of muga silkworm (Das et al., 2006).

The two hormone 20 hydroxyecdysone (20HE) and juvenile hormone (JH) are the major circulating hormones in insects which control majority of growth and developmental activities (Novak, 1975). Exogenous application of these two hormones could induce larval activities and create normal insect development. Plant-produced insect moulting hormones, termed phytoecdysteroids (PEs), function as plant defenses against insects by acting as either feeding deterrents or through developmental disruption (Schmelz et al., 2002).

Rearing performance affects sharply in their ecological, biochemical, physiological and quantitative characters, which influence growth and development, and quantity and quality of silk they produce in different geographical locations, and thus, varies under different ecological conditions to make silkworm rearing cost effective and more productive (Hirobe, 1968; Shekharappa et al., 1993). Therefore, this study was conducted to evaluate the performance of muga silkworm growth, development and quality cocoon production which increase fecundity after application of Juvenil hormone III and 20 hydroxyecdyxon.

MATERIAL AND METHODS

The larvae of muga silkworm *Antheraea assamensis* were reared on som *Persia bombycina* plant as usual practices in Central Muga Eri Research and Training Institute. When the larvae attain in 5th inster just after molting apply hormone at appropriate doses. The two hormone namely Juvenil-III and 20 hydroxyecdyson (20E) with three different concentrations i.e. 5µl,10 µl and 15 µl is formulated (Miranda et al., 2002). Exogenous application at 5th inster 1st day old larvae by tropically at doses within the normal physiological range with this three different concentration along dorsal midline using appropriate Micro Syringe (Mizoguchi et al ., 2001). Untreated set of larvae consider as control.

Cocoons of different treatments were kept separately in rearing cage (30 cm x 30 cm x40 cm) until emergence. In the first two hours after emergence, the insects were coupling both artificially and naturally. All the insects were maintained at 25 ± 2°C, 70 ± 5% RH and natural light. The potential fecundity (number of eggs deposited plus eggs remaining in ovaries after three day) of treated females was recorded by dissecting the female moths.

RESULTS

The impact on rearing performance in muga silkworm *Antheraea assamensis* the larval duration, % of cocoon formation, shell and pupal weight, fecundity , retained eggs, ovaries length, silk ratio and thickness of silk were considered. The results indicate that the two hormones after application significantly increased fecundity, larval, cocoon and pupal weights, silk ratio and thickness of silk with comparisons to control groups.

EFFECT OF JH-III HORMONE TREATMENTS:

The rearing performance among the three different concentration of JH-III, the 10 µg is most effective resulting (81.33±0.88 %) of cocoon formation, (4.990±0.04gm) single pupal weight, (0.450±0.02 gm) shell weight, (165±13.22 nos) fecundity, and prolong 5^{th} inster larval duration to (8 ±0.57) days. The length of ovary is significantly longer when insects are treated with JH-III (10 µg) measuring (9.26±0.24cm) while it is (9±0.25cm) in control female. This situation suggests that the treatment of JH-III 10 µg promote ovarian development with more egg formation .Eggs are less retained in the abdomen when treated with JH-III10µg (9.66± 0.88nos) than control (33.33±3.28 nos). The thickness of silk is also more in JH-III 10µg (5.044±0.56 cm) and silk ratio (9.023 ±0.05 %) then the other treatments.(Figs. 1-4).

EFFECT OF 20 HE HORMONE TREATMENTS:

The rearing performance among the three concentration of 20 E the 15µg is most effective resulting (86.2±3.00 %) of cocoon formation, (5.638±0.28 gm) single pupal weight, (0.483±0.01gm) shell weight, (179.33 ±8.35 nos) fecundity, and shortened 5^{th} inster larval duration to (6 ±0.57) days. The length of ovary is significantly longer when insects are treated with 20-HE (15 µg) measuring (11± 0.40 cm) while in untreated normal female it is (9±0.25 cm). It is also suggests that the treatment of 20-HE (15µg) promote ovarian development with more egg formation. Eggs are less retained in the abdomen when treated with 20E 15µg (12±2.08) than control (33.33 ±3.28) nos. The thickness of silk is more in 20HE 15µg (5.188±0.10) and silk ratio (8.346 ±0.29) but in control (4.247±0.31) and (5.596 ±0.20) respectively. (Figs. 1-4).

DISCUSSION

In insects, virtually all life processes are regulating by neural and endocrine system. Basically brain hormone, molting hormone and juvenile hormone are involved in regulating insect development (Dhaliwal & Arora Ramesh, 2001). In this study revile that the 20 hydroxyecdysone decreased shortly after application of JH-III would bounce back and reach the maximum peak on the seventh day which results longer the larval duration (first days old larvae after the treatment).The same phenomenon was reported by Trivedy et al. (2006) in which fifth instar of *B. mori* treated with a low dose of juvenile hormone R394 topically to stadium of 24 hours did not show any distinct effect to its ecdysteroid titer until the sixth day. On the seventh day, ecdysteroid titer dropped significantly until it began making a cocoon. Larvae treated with low dose at a stadium of 48, 72, and 96 hours showed a reduction in their ecdysteroid titer starting from the fifth day to the seventh day and would increase again on the eight day, when they began making cocoon.

In sericulture, Juvenile hormone analogues and also ecdysteroids have been tested in *Bombyx mori* as insect growth regulators in order to increase silk production (Baruah et al., 1998; Choudhury et al., 1998). The application of methoprene by spraying or immersion of the leaves into the products has been reported to increase fecundity in *Antheraea yamamai* (Gongin et al., 1999). Changamma et al. (2000) also observed increment of fecundity, weight of testis and ovaries when 5^{th} instar larvae of *B. mori* were treated with methoprene.

In this studies the treatment of 20 hydroxyecdysone (a moulting hormone) larvae become shortened their larval period (5.8±0.37) and give the good rearing performance of all the parameter may be because of suppressed to synthesis of normal juvenile hormone which is present in a normal insect in low concentration with compared to untreated control larvae. Under normal conditions, the production of ecdysone by the corpora cardiaca in the fifth instars muga larvae is supposed to decrease or stop. But, because of the tropically application of 20 hydroxyecdysone inside the blood remained high. It led to a change on the normal condition of ecdysone hormone inside the insect body result the high weight of cocoon, more fecundity; length of ovary is long etc. The same work done by Levine et al. (1986) topical application of a juvenile hormone analog in *M. sexta* to the peripheral cell bodies of these sensory neurons during a critical period of development caused them to retain their larval commitment rather than undergo pupal development with the rest of the animal.

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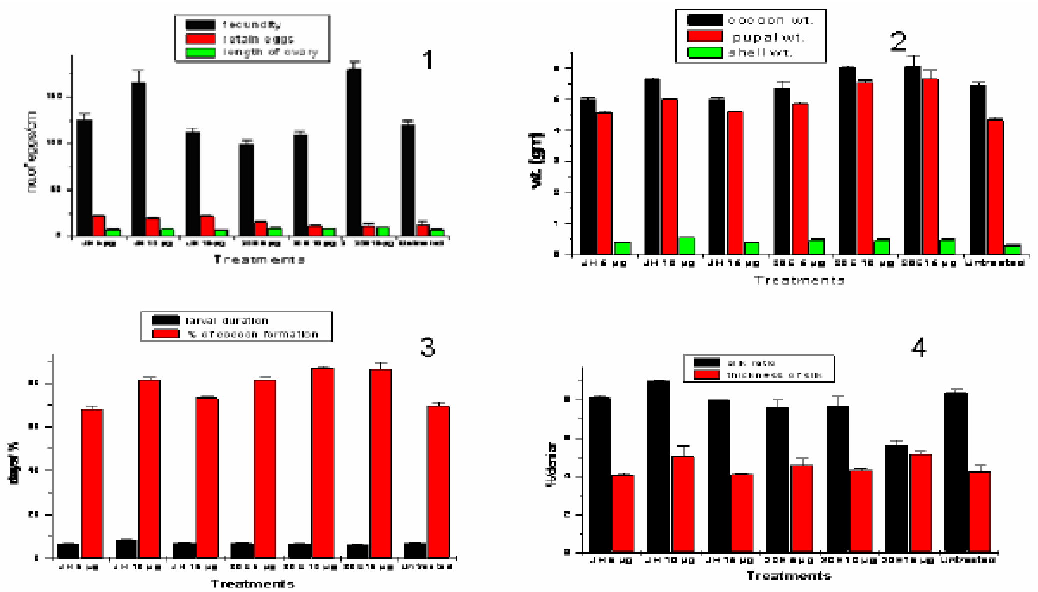

Figures 1.Comparisons of fecundity, retain eggs and length of ovary 2. Comparisons of cocoon wt, pupal wt and shell wt 3. Comparisons of larval duration and cocoon formation 4. Comparisons of silk ratio and thickness of silk of treated and untreated muga silkworm. All the columns represent (averages ± SE) of the mean.

Figures 1. 5th inster larvae treated with 20E (15 µg) 2. Grainage activity of treated moths 3. Silk treated with 20E (15 µg) 4. Mesurment of ovary length with JH-III treatment.