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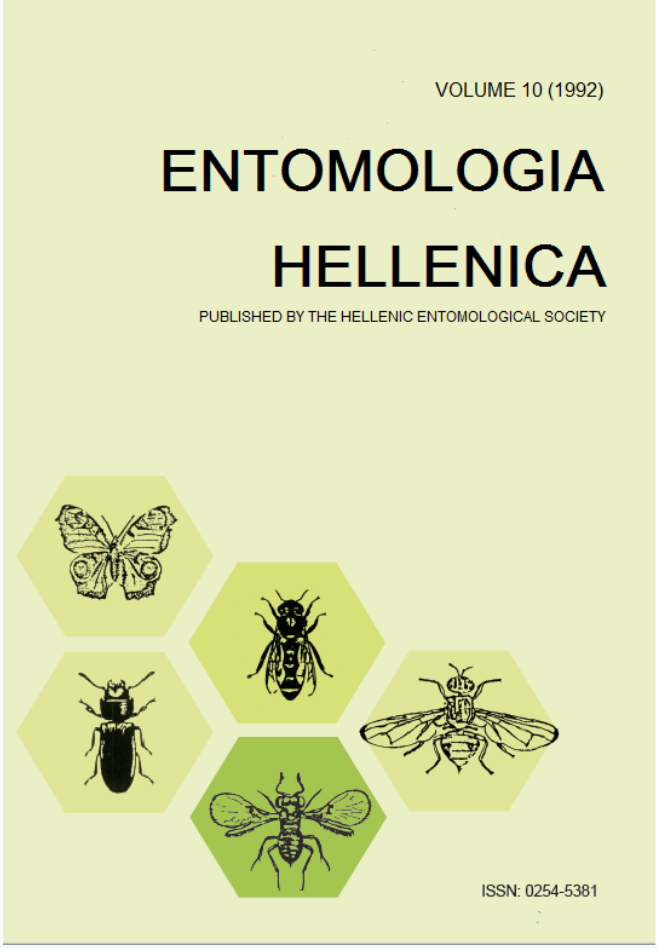

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Effect of 17β Estradiol on the Economic Parameters of silkworm, *Bombyx mori*[1]

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ABSTRACT

The effect of 17-β estradiol on the precocooning and post cocooning parameters of silkworm (Pure Mysore breed) were studied. The 17-β estradiol of 1, 5 and 10 µg/ml concentration was topically applied independently at 36h to III, IV and V instar larvae (Treatment-1), at 48h to IV and V instar larvae (Treatment-2) and at 72h to V instar larvae (Treatment-3). The repeated applications with each concentration of 17β estradiol in Treatment 1&2 larvae or single application in Treatment 3 variously affected the precocooning and post cocooning parameters. The repeated applications of 1µg 17-β estradiol (Treatment-1) improve the fecundity and decrease the larval duration, cocooning and moth emergence percentages.

Introduction

In recent years vertebrate hormones and hormone-like compounds have been detected in insects and in other invertebrates (De Loof 1987, Lafont 1991). The estradiol like bodies were identified in ovaries of *Attacus atlas* (Loewe 1931), in *Locusta migratoria* (Novak and Lambert 1989), in *Bomyx mori* (Ohnishi et al. 1985) and in total body of *Sarcophaga bullata* (Mechoulam et al. 1984) by using bioassay, radioimmunoassay (RIA), gas chromatography and mass spectrometry. Ogiso and Ohnishi (1986) found a considerable effect of estradiol on oviposition in the silkworm at high doses. But these studies did not either explain the physiogical function of the estradiol in the silkworm ovary or the economic parameters of the silkworm. Hence, an attempt has been made to study the effects of 17-β estradiol on *Bombyx mori* L. by studying its effects on the economic parameters of the insect.

Materials and Methods

The Pure Mysore breed of silkworm was reared in the laboratory (Krishnaswami 1978). The larvae were maintained on fresh mulberry leaves (K2 variety). The third, fourth and fifth instar larvae constituted three different experimental groups. Each group was further divided into subgroups, each consisting of 20 individuals. Each subgroup consists uniformly weighing larvae of five replications (20 × 5). The 17-β estradiol (M/s Sigma Co., USA) was dissolved to 1, 5 and 10 µg/ml in acetone. The topical application was made with small sterilized cotton ball on the dorsal side of the larvae. Each larva was treated at particular hour after the ecdysis. Each subgroup was topically applied with one of the three doses of 17-β estradiol to 3rd to 5th instar larvae treated at every 36h in each stadium (Treatment-1), to 4th and 5th instar larvae treated at 48h in each stadium (Treatment-2) and to 5th instar larvae treated at 72h in 5th stadium (Treatment-3) independently. In each application four ml of solution was used to treat 100 larvae. The amount of 17-β estradiol

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absorbed by the larval cuticle was not known. Acetone treated controls were also maintained for each experimental group. Common untreated control was also kept. After the treatment the silkworms were reared at 25-27°C temperature and 60-65% RH. After the treatment, fresh larval weight and silkgland weight of five larvae were recorded on 6 day old 5th instar larvae. Larval duration for the Treatment 1 and 2 was recorded for the entire larval period and the same was recorded only in the 5th instar for Treatment 3. The cocooning and moth emergence and fecundity were also recorded. The mean values are shown in Table 1. Each mean value is the average of 5 samples from five replications of two trials. The data collected were subjected to one way analysis of variance test to find out the significance between the parameters of treated groups and the corresponding parameters of untreated controls (Raghava Rao 1982). The percent value of cocooning and moth emergence were transformed to sine angular values for statistical analysis.

Results and Discussion

Larval weight

Larval weight was improved significantly by the repeated application of all the doses of 17-β estradiol in Treatment-2 when compared with that of Treatment-1, 3 and both controls (Table 1).This indicates that 17-β estradiol responds to 48h old larvae in 4th and 5th instar larvae (Treatment-2). This improvement in the larval weight may be attributed to the growth stimulatory effect of the hormone on the silkworm.

Silkgland weight

The wet weight of the silkgland did not show any significant changes in all Treatments 1 to 3. The response of the silkgland to hormone was poor and needs further investigation.

Larval duration

The larval duration was shortened in 1 and 5 µg/ml repeated application of 17-β estradiol in Treatment-1 and 2 ($P < 0.05$). But application of 10 µg/ml in Treatment-1 and 2 and all doses of single application of hormone in Treatment-3 did not decrease the larval duration when compared to controls.

Cocooning (%)

All the doses of single and repeated applications of 17-β estradiol in Treatment-1 to 3 decreased the cocooning when compared to that of controls except in the 5 µg/ml 17-β estradiol treated group in Treatment-2. The decrease in the cocooning may be attributed to the mortality of larvae during larval stage.

Moth emergence percentage

All the applications of 17-β estradiol in Treatment 1-3 significantly decreased the moth emergence percentage. The decrease in the moth emergence percentage may be attributed to the increased mortality in pupal/moth stage.

Fecundity

There was a significant increase in the fecundity in all 17-β estradiol treated groups of Treatment-3; and in 1 µg/ml estradiol treated group of Treatment-1; but it was significantly decreased in 10µg/ml estradiol treated group of Treatment-1. In all other treated groups there was no significant increase/decrease in the fecundity when compared with untreated controls. It is supposed that age of silkworm (i.e. 72h) is responsible for better effect of 17-β estradiol on egg production. The increase in egg production might be due to the possible role of estradiol in egg maturation as reported by Ogiso and Ohnishi (1986).

Hormones are molecules that carry messages and their structures have been quite conserved during evolution; this means that identical or at least very similar molecules (both for messages and their receptors) can be found in vertebrates and invertebrates. But this does mean that the messages that they carry are equally conversed, either between vertebrates and invertabrates or even within invertebrates (Lafont 1991). Vertebrate steroids may evoke dose dependant effects on insect development that resemble those of juvenoids (Sita et al. 1981, 1983). The widespread occurrence of vertebrate steroids in insects may be due to their existance in the food plants (Heftman, 1975). The mere existance in the insect body did not explain their role in activities of the insect. However, topical application of estradiol to silkworm pupae/moths decreased the oviposition of eggs (Ogiso and Ohnishi 1986). The increase in fresh larval weight, fecundity and decrease in cocooning, moth emergence and larval duration needs further experiments to know the possible role of 17-β estradiol in

TABLE 1. Effect of 17-β estadiol on economic parameters of silkworm *B. mori.*

Group/Dose		Larval weight (fresh) (g)	Silkgland weight (g)	Larval duration (h)	Cocooning percentage	Moth emergence percentage	Fecundity (no.)
3rd to 5th instar larvae treated every 36h	A1(1 μg)	1.598	0.306	642ab	80.0ab 63.52*	80.0ab 63.52*	297ab
	A2 (5 μg)	1.619	0.317	642ab	88.0ab 70.26*	84.0ab 66.36*	246
	A3 (10 μg)	1.692	0.311	666	92.0a 74.09*	75.0ab 60.05*	188ab
4th and 5th instar larvae treated every 48h	B1(1 μg)	1.722b	0.338	642ab	86.0ab 68.11*	80.0ab 63.52*	213
	B2(5 μg)	1.834ab	0.383	642ab	92.0 75.35*	85.0ab 68.11*	229
	B3(10 μg)	1.795ab	0.340	666	86.0ab 66.81*	83.0ab 65.95*	235
	Acetone control	1.493	0.318	666	96.0 78.16*	94.0 77.20*	216
	Untreated control	1.599	0.339	666	97.0 80.33*	95.65 78.65*	226
SE+		0.071	NS	3.155	1.866	1.411	11.93
CD at 5%		0.208		9.137	5.404	4.086	34.55
5th instar larvae treated at 72h	C1 (1μg)	1.710	0.336	189	87.0ab 69.22*	88.5a 70.21*	275ab
	C2 (5μg)	1.699	0.353	188	81.0ab 65.72*	86.6ab 68.73*	273ab
	C3 (10μg)	1.694	0.376	189	83.3ab 65.92*	86.2ab 68.21*	300ab
	Acetone control	1.578	0.325	189	95.0 78.65*	90.0 71.65*	237
	Untreated control	1.665	0.373	189	97.0 80.25*	92.0 73.73*	231
SE+		NS	NS	NS	1.035	0.974	11.83
CD at 5%					3.0	2.822	34.26

* Angular transformed figures, a-Significant over the untreated control, b-Significant over the acetone treated control.

physiological activities of the silkworm, *B. mori.*

From the present study, it can be concluded that the 17-β estradiol has significant effects on larval weight, larval duration, fecundity, cocooning and moth emergence of the silkworm, *B. mori.* The practical utility of this study needs further experimentation to modify and confirm these results using different breeds of silkworm.

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KEY WORDS: Silkworm, *Bombyx mori,* 17-β estradiol, Economic parameters.

Επίδραση της 17-β Εστραδιόλης στις Οικονομικές Παραμέτρους του Μεταξοσκώληκα *Bombyx mori*

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ΠΕΡΙΛΗΨΗ

Μελετήθηκε η επίδραση της 17-β εστραδιόλης σε παραμέτρους προ και μετά το σχηματισμό βομβυκίου του μεταξοσκώληκα (καθαρή φυλή Mysore). Η 17-β εστραδιόλη χορηγήθηκε σε συγκεντρώσεις 1, 5 και 10 μg/ml με τοπική εφαρμογή ανεξάρτητα, σε 36h στα προνυμφικά στάδια III, IV και V (Μεταχείριση 1), σε 48h στα στάδια IV και V (Μεταχείριση 2) και σε 72h στο V στάδιο (Μεταχείριση 3). Οι επανειλημμένες εφαρμογές με κάθε συγκέντρωση της 17-β εστραδιόλης στις μεταχειρήσεις 1 και 2 ή η απλή εφαρμογή στη μεταχείριση 3 επηρέασαν διαφορετικά τις προ και μετά το σχηματισμό βομβυκίων παραμέτρους. Η επανειλημμένη εφαρμογή 1 μg/ml 17-β εστραδιόλης (Μεταχείριση 1) βελτίωσε την ωοπαραγωγή και μείωσε τη διάρκεια προνυμφικής ανάπτυξης, το σχηματισμό βομβυκίου και το ποσοστό εξόδου των τελείων.