

Effect of Testosterone Propionate on the Economic Traits of the Silkworm, *Bombyx mori* L.

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Abstract

Effects of topical application with 1, 5 and 10 $\mu\text{g/ml}$ testosterone propionate on the precocooning and post cocooning traits of the polyvoltine. Pure Mysore breed of silkworm were studied. Each concentration was treated independently at 36th to III, IV and V instar larvae (Treatment-1), at 48th to IV and V instar larvae (Treatment-2) and at 72th to V instar larvae (Treatment-3). The repeated applications with each concentration of testosterone propionate in treatment, and 2 larvae or single application in treatment 3 variously affected the precocooning and post cocooning traits. Repeated applications of all doses of testosterone propionate (Treatment-1) and single application of 1 & 5 μg of the chemical (Treatment-3) increase the fecundity and decrease the percentage of cocooning and moth emergence.

Key words : Testosterone propionate, silkworm, economic traits, *Bombyx mori*

Introduction

It is reported the presence of vertebrate hormone like compounds in insects and crustaceans (De Loof, 1987; Lafont, 1991). Recently, testosterone-like immuno reactive substance was identified in the haemolymph of larval and pupal stages of silkworm by radio immunoassay (RIA) (Nagashima *et al* 1983). Treatment of testosterone decreased the rate of oviposition and hatchability of eggs in silkworm (Ogiso and Onishi, 1986). But these studies were unable to explain the physiological function of testosterone in the silkworm or on the economic traits. Hence an attempt has been made to know the physiological effect of testosterone propionate on *Bombyx mori* by studying its effects on the economic traits of *B. mori*.

Materials and Methods

The Pure Mysore breed of silkworms was reared

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by Krishnaswami method (1978). The worms were maintained on fresh K2 mulberry leaves. The third, fourth and fifth instar larvae were sorted into three different experimental groups. Each group was further divided into sub-groups, each consisting of 20 worms of five replications. The testosterone propionate (M/s Sigma Co, USA) was dissolved in small quantity of acetone and diluted to 1, 5 and 10 $\mu\text{g/ml}$ by adding acetone. The topical application was made with small sterilized cotton ball. Each sub-group was topically applied with one of the three doses of testosterone propionate at 36h in III, IV and V instar larvae, at 48h in IV and V instar larvae and at 72h in V stadium larvae independently. In each application 4 ml of solution was used to treat 100 worms. Acetone treated controls were also maintained for each experimental groups, and common untreated control was also kept.

After the treatment, larval weight, silkgland weight, larval duration, percentage of cocooning and moth emergence, and fecundity were recorded. The mean values are shown in Table 1 and 2. Each mean value is the average of 20 worms from five

Table 1. Effect of repeated application of testosterone propionate (TP) on economic parameters of silkworm, *B. mori*

Group/Dose	Larval weight (g)	Silkgland weight (g)	Larval duration (Hr)	Cocooning (%)	Moth emergence (%)	Fecundity (no.)
I A1(1 µg)	1.602	0.370	666	88.0ab 70.25**	89.4ab 70.97**	285ab
A2(5 µg)	1.684	0.298	666	88.0ab 70.68**	84.21ab 66.45**	295ab
A3(10 µg)	1.690	0.313	666	90.0ab 71.87**	91.10ab 72.94**	304ab
B1(1 µg)	1.626	0.291	666	90.0ab 71.87**	86.0ab 68.37**	201
II B2(5 µg)	1.638	0.374	666	84.0ab 66.36**	75.0ab 64.05**	184
B3(10 µg)	1.716	0.337	666	92.0a 73.32**	94.0 75.29**	268b
III Acetone control	1.638	0.317	666	96.0 78.16**	94.0 77.20**	214
IV Untreated control	1.716	0.338	666	97.0 80.33**	95.65* 78.65**	225
SE + CD at 5%	NS	NS	NS	1.820 5.331	3.080 7.710	10.812 44.79

** Angular transformed figures, a-Significant over the untreated control, b-Significant over the acetone treated control, A1-A3-Repeated applications of TP at 36h in 3rd, 4th and 5th instar of silkworm larvae, B1-B3-Repeated applications of TP at 48h in 4th and 5th instar of silkworm larvae.

Table 2. Effect of single application of testosterone propionate (TP) on economic parameters of silkworm, *B. mori*

Group/Dose	Larval weight (g)	Silkgland weight (g)	Larval duration (Hr)	Cocooning (%)	Moth emergence (%)	Fecundity (no.)
I C1(1 µg)	1.681	0.348	189	83.30ab 66.29**	85.4ab 67.73**	303ab
C2(5 µg)	1.656	0.367	189	91.07ab 72.59**	78.43ab 62.37**	282a
C3(10 µg)	1.738	0.376	189	90.9ab 72.20**	84.0ab 66.49**	239
II Acetone control	1.578	0.322	189	95.0 78.65**	90.0 71.64**	237
III Untreated control	1.665	0.373	189	97.0 80.33**	92.0 73.73**	232
SE + CD at 5%	NS	NS	NS	1.559 4.445	1.239 3.588	12.335 35.72

See Table 1

C1-C3-Single application of TP at 72h in 5th instar of silkworm larvae.

replications. The experiments were conducted twice to conclude the results.

The data collected were subjected to the variance test to find out the significance between the para-

meters of the treated groups and the untreated controls (Raghava Rao, 1983). The percent values of cocooning and moth emergence were transformed into sine angular values for statistical analysis.

Results and Discussion

Larval weight

There was no significant increase or decrease in the larval weight in repeated or single applications of testosterone propionate (Table 1 and 2). The nonresponse to the hormone on the larval weight might be due to nonresponse of the breed or critical time of application.

Silk gland weight and larval durations

The wet weight of the silk gland and larval duration did not show any significant changes to the repeated or single applications of the hormone. The response of the silk gland weight or larval duration to hormone was poor and needs further investigation.

Cocooning percentage

All doses of single and repeated applications of testosterone propionate at 72h in V instar larvae, at 36h in III, IV and V instar larvae and at 48h in IV and V instar larvae decreased the cocooning percentage except 10 µg testosterone propionate treated group at 48h in IV and V instar larvae (Table 1). The decrease in cocooning percentage may be attributed to the mortality of the larvae during larval stage.

Moth emergence percentage

There was a significant decrease in the moth emergence (%) in repeated application of 5 µg testosterone propionate (TP) at 36h in III, IV and V instar larvae and 1 µg and 5 µg TP at 48h in IV and V instar larvae (Table 1 & 2). The decrease in moth emergence percentage may be attributed to increased mortality in pupal/moth stage.

Fecundity

There was a significant increase in the fecundity in repeated applications of all doses of TP at 36h in III, IV and V instar larvae, single application of 1 µg and 5 µg TP at 72h in V instar larvae (Table 1 & 2). The repeated applications of 10 µg of TP significantly ($P < 0.05$) increased the fecundity. It is presumed that age of the silkworm (36h) is respon-

sible for the better effect of TP on the egg production. The increase in the egg production might be due to growth stimulatory effect of TP.

Hormones are molecules that carry messages and their structures have been conserved during evolution; this means that identical or at least very similar molecules (both message and their receptors) can be found in vertebrates and invertebrates. This does not mean that messages carry equally conversed either between vertebrates and invertebrates or even within invertebrates. Vertebrate steroids may evoke dose dependent effects on insect development that resembles those of juvenoids (Lafont, 1991). Nagashima *et al.* (1983) reported the presence of testosterone-like immunoreactive substance in the haemolymph of male female silkworm in their developmental stages through RIA. They also reported that testosterone like immunoreactive substance is more in male than female and its titre was peak during 4th ecdysis and falls down on 4th day of fifth instar larval stage in male while it falls down on 6th day of fifth instar of larval stage in females. It was reported that testosterone-like immunoreactive substance is identified in mulberry leaves and in the haemolymph of *B. mori* (Venkataramireddy, 1992). The possible role of this hormone in insect body system needs further investigation. The possible explanation for the increase/decrease in the parameters studied here needs further study.

It may be concluded from the present study that testosterone propionate has some effect on cocooning, moth emergence and fecundity in silkworm, *B. mori*.

摘 要

Testosterone Propionate가 가잠의 실용형질에 미치는 영향

多化性계통의 1종인 Pure Mysore 품종에 대한 testosterone propionate (TP)의 농도별 (1, 5, 10 µg/ml) 투여효과를 조사하였다. TP의 처리는 유충 3, 4, 5령의 36시간째 투여구(처리-1), 4, 5령의 48시간째 투여구(처리-2) 및 5령 72시간째 투여구(처리-3)의 3개 시험구를 설정하여 농도별로 피부에 침투하였다. 실험 결과 모든 시험구에서 TP 처리는 산란성에 증대효과를 보였으나, 화용비율 및 발아비율은 대조구에

비해 떨어지고 있었다.

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