Increase in Silk Production by the Silkworm, *Bombyx mori* L., due to Oral Administration of a Juvenile Hormone Analog

Sir:

Till recently, it was generally considered that the practical utilization of juvenile hormones and related compounds would be developed in the area of insect control due to the disruptions of physiological and biochemical systems specific to insects. In a preceeding paper,¹⁾ however, we reported that fifth instar larvae of the silkworm, *Bombyx mori* L., to which some 3,4-methylenedioxyphenyl derivatives structurally related to Cecropia juvenile hormones were topically applied, produced giant cocoons. We suggested that this procedure could be utilized to increase the silk productivity of the insect. Subsequently, we examined the effect of a juvenile hormone analog from this series on silk production using oral administration.

Fifth instar larvae of the silkworm were reared on an artificial diet, which was prepared by mixing mulberry leaf powder (50.0%), defatted soybean meal (24.0%), cellulose powder (15.0%), agar powder (5.0%), citric acid (4.0%), L-ascorbic acid (1.5%) and sorbic acid (0.5%) with distilled water (2.5 ml/g solid) followed by steaming at 80~85°C for 15 min. The juvenile hormone analog, 1-(3, 4-methylenedioxyphenyl)-5,9-dimethyl-8-epoxy-1,4-decadiene (I), composed of stereoisomers, was used

solely throughout this experiment because of its accessibility through synthetic preparation²⁾ and its favorable biological effect.¹⁾ A given amount of the reagent was dissolved in a small amount of acetone, then mixed with diet components before adding water. Ten larvae of the hybrid 8.3×3.4 were used for each dose and were kept at 25~27°C. The body weight of each larva was measured 144 hr after the fourth molt. A weight measurement was made for each cocoon and the cocoon-layer taken from it after complete spinning.

In a preliminary trial, we fed the reagent for 48 hr in dietary doses of 0.5, 1.0 and 2.0 ppm to fifth instar larvae of various growth stages to find the best time for administration. Early stage feeding (during the 48 hr just after the fourth molt) was almost ineffective for increasing cocoon weight, even at a dosage of 2.0 ppm. However, middle stage feeding (during the 48th~96th hr of the instar) prolonged duration of the larval stage, which resulted in increases in both the cocoon and cocoon-layer weights. This efficacy became distinct as the dose increased.

We, then, investigated the effect of the compound at higher doses (2.0, 4.0 and 8.0 ppm) at the middle stage of the instar. Typical results are illustrated in Table I. A dose of 4.0 ppm had the most favorable effects. At this level, the instar was prolonged 66.4 hr (147.6 hr with the control), resulting in an increase in the cocoon-layer weight 1.41 times that of the control. Administration of 8.0 ppm produced heavier cocoons, but the ratio

TABLE I. GROWTH AND METAMORPHOSIS IN FIFTH INSTAR LARVAE OF THE SILKWORM ORALLY ADMINISTERED COMPOUND I

The same numbers of males and females were used for each dose.

The compound was fed during the 48th~96th hr of the instar.

Content of compd. in diet, ppm	Initial larval wt. g	Larval wt. 144 hr after 4th molt, g	Length of 5th instar, hr	Wt. of cocoon, g	Wt. of cocoon-layer, g	Ratio of cocoon-layer, %
0	0.620	3.219	147.6	1.423	0.283	19.9
2	0.650	3.882	193.3	1.787	0.385	21.5
4	0.650	3.900	214.0	1.920	0.398	20.7
8	0.645	4.025	225.0	2.050	0.380	18.5

of cocoon-layer weight to cocoon weight was smaller than that of the control.

We, also, examined the efficacy of the compound, when it was fed for 24 hr at 2.0, 4.0 or 8.0 ppm in the diet. In general, administration during the 48th~72nd, 72nd~96th or 96th~120th hr of the final instar induced significant increases in cocoon-layer weights varying 20~35% with the dose tested. Feeding at 8.0 ppm during the 72nd~96th hr was the most effective. Administration at a later stage (during the 120th~140th hr) revealed hardly any promotive effect even at 8.0 ppm.

Thus, we have demonstrated that productivity of silk can be enhanced through oral administration of juvenile hormones to fifth instar larvae of the silkworm, though the yield was not as remarkable as that with topical application.¹⁾

REFERENCES

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Shigeo MURAKOSHI
Ching-Fun CHANG*
Saburo TAMURA*†

Kanagawa Prefectural Institute for
Sericultural Science
Ebina-shi, Kanagawa-ken
*Department of Agricultural Chemistry
The University of Tokyo
Bunkyo-ku, Tokyo

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† To whom all correspondence should be addressed.