

EFFECT OF JUVENILE HORMONE ANALOGUES R77 AND W328 ON THE SILKWORM, *BOMBYX MORI* L.

In Japan and China, several juvenile hormone analogues (JHAs) have been successfully used to improve the silk production through extension of the larval life (Akai *et al.*, 1971). In India, attempts were also made to improve the economic characters like cocoon and shell weight (Chowdhary *et al.*, 1990, Trivedy *et al.*, 1992). In the present study, two new juvenile hormone analogues viz. R77 and W328 were tested for the first time in sericulture for growth promoting activity and improvement of silk in the tropical silk worm breed.

The silk worm rearing (breed : KA) was conducted following standard procedure (Krisl Osvami, 1979). The juvenoids, R77 and W328 (gift samples from Dr. L. Streinz, Institute of Organic Chemistry and Biochemistry, Czechoslovakia) were applied topically with different doses ($10^1 \mu\text{g}$ to $10^{11} \mu\text{g}$ per $5 \mu\text{l}$ of acetone per larva) at 24, 48, 72 and 96 h of fifth instar of silk worm *Bombyx mori*. One batch of larvae treated with JHA at 48 h was again treated at 72 h with $125 \mu\text{l}/\text{larvae}$ of plant *Cassia tora* extract containing phytoecdysteroid ($3 \mu\text{g}/\text{ml}$) hormone. Three replications of 20 larvae were kept for each treatment. Same number of larvae were treated with $5 \mu\text{l}$ acetone as media control and same number of larvae also kept without any treatment as control in the same rearing house. After the treatment, data on daily increment in body weight, survival, anatomical and morphological changes were recorded. The data were also analysed to find the significant difference among the treated and control larvae. The experiment was repeated three times to conclude the results. Data on body weight and survival of the larvae treated at 72 h with some selected doses of both the hormones are presented in Tables 1 and 2.

The results indicate that the larval growth was maximum in treatment of V instar larvae aged 72 h with both R77 and W328 hormones. The larval weight gradually increased up to 8th day without any sign of spinning. From 8th day

onwards, the larval weight gradually decreased due to reduced consumption of mulberry leaf. These larvae then started shrinking and the body colour changed to whitish. The survival on 11th day was significantly lower as compared to the controls. It was also observed that alimentary canal was filled with gelatinous material on the 12th day. The anterior region of middle part of silk gland became reddish brown in colour. It is interesting to note that the control larvae were also unable to spin the cocoon. Similar observations were noticed in all the three trials.

It has been reported that topical application of high doses of JHA induced prolongation of larval duration in the last instar without the sign of spinning (Akai and Kobayashi, 1971). It has been observed by Sbrenna *et al.* (1992) that Fenoxycarb (insect growth regulator) inhibited metamorphosis and consequently cocoon spuming even after the administration of ecysteroids to the same larva which induced supernumerary larval moult showing that this insect growth regulator interfere the modification of larval commitment and induce nonspinning syndrome even in the controls. Phytoecdysteroid (*Cassia tora* extract) was topically applied to silk worm at 72 h for initiation of early spinning in silk worm and reported that about 70% of larvae matured early for spinning (Shivakumar *et al.*, 1993). On the contrary, in the present study all the treated larvae have shown nonspinning syndrome even after treatment with phytoecdysteroid. Low doses of many JHAs result in prolongation of larval duration by a few hours to 3 days resulting in increase in cocoon weight and shell weight by 5-20% (Akai and Kobayashi, 1971). The present study reveals that treatment of even very low doses of R77 and W328 adversely affects the maturation and spinning behaviour. Nonspinning behaviour of control larvae maintained along with the treated ones suggests that the hormones are highly potent in their chemical nature like Fenoxycarb. The probable endocrinological

Table 1. Effect of R77 and W328 on daily weight of silk worm *Bombyx mori* treated on the third day of fifth instar, g / larva

Dose (μg)	Days										
	1	2	3	4	5	6	7	8	9	10	11
R77											
10^1	-	-	2.674	3.146	3.372	3.532	3.855	3.918	3.648	3.855	3.341
10^{-1}	-	-	2.720	3.212	3.371	3.431	3.508	3.691	3.582	3.469	3.314
10^{-3}	-	-	2.501	3.006	3.208	3.266	3.559	3.762	3.677*	3.436	3.270
10^{-5}	-	-	2.750	3.329	3.435	3.382	3.784	4.013	3.912	3.629	3.458
10^{-7}	-	-	2.777	3.078	3.245	3.469	4.293	4.011	3.888	3.726	3.503
10^9	-	-	2.868*	3.363	3.569	3.783	4.277	4.671	4.757	3.987	3.800
10^{-11}	-	-	2.538	2.988	3.198	3.470	3.842	3.998	4.007	3.914	3.715
W328											
10^1	-	-	2.626	3.035	3.337	3.347	3.683	3.623	3.613	3.344	3.183
10^{-1}	-	-	2.723	3.253	3.476	3.756	4.321	4.346	4.028	4.016	3.865
10^{-3}	-	-	2.474	7.918	3.087	3.188	3.444	3.436	3.407	3.279	3.368
10^{-5}	-	-	2.756	3.267*	3.450	3.702	3.993	3.919	3.763	3.544	3.489
10^{-7}	-	-	2.901	3.397	3.580	3.693	4.057	4.094	3.909	4.066	3.868
10^9	-	-	2.577	3.078	3.303	3.522	3.908	3.945	3.815	3.588	3.534
10^{-11}	-	-	2.741	3.413	3.630	3.930	4.084	4.265	3.816	3.640	3.484
Control	1.546	2.333	2.875	3.270	3.513	3.637	3.724	3.787	3.682	3.569	3.397
SE \pm			0.003	0.003	0.002	0.002	0.003	0.002	0.002	0.002	0.002
CD (0.01)			0.012	0.011	0.009	0.009	0.012	0.009	0.010	0.007	0.007

Data are significant at 0.01 level differing from control except * marked

reason attributed to the **nonspinning** is that the inhibitory action of these JHAs may be manifested either by preventing the brain from secreting the **prothoracicotropic hormone (PTTH)** needed for ecdysone synthesis /

release or triggering the elevation of the high JHA / ecdysone in the system. It is concluded that the two JHAs tested in the present study may not be suitable to use in the sericulture industry.

Table 2. Effect of R77 and W328 on survival percentage of larva of silk worm *Bombyx mori* treated on third day of fifth instar

Dose (μg)	Days									
	3	4	5	6	7	8	9	10	11	
R77										
10^1	100.00	100.00	100.00	95.00	94.74	89.47	84.21	66.67	61.11	
10^{-1}	100.00	95.00	95.00	95.00	94.74	68.42	57.89	55.56	50.00	
10^{-3}	100.00	100.00	100.00	100.00	100.00	89.47	84.21	72.22	61.11	
10^{-5}	80.00	80.00	80.00	80.00	78.95	68.42	63.16	61.11	55.56	
10^{-7}	95.00	95.00	95.00	95.00	94.74	89.47	78.95	83.33	83.33	
10^9	100.00	100.00	100.00	100.00	105.26	94.74	84.21	88.89	83.33	
10^{-11}	95.00	90.00	90.00	90.00	* 94.74	94.74	89.47	83.33	77.78	

Table 2 (contd.)

W328									
10 ⁻¹	100.00	95.00	95.00	95.00	100.00	100.00	78.95	55.56	55.56
10 ⁻¹	100.00	100.00	100.00	100.00	100.00	100.00	100.00	88.89	77.78
10 ⁻³	85.00	85.00	85.00	85.00	84.21	78.95	78.95	83.33	66.67
10 ⁻⁵	100.00	100.00	100.00	100.00	105.26	105.26	105.26	100.00	77.78
10 ⁻⁷	90.00	90.00	90.00	90.00	84.21	84.21	84.21	61.11	55.56
10 ⁻⁹	95.00	90.00	90.00	90.00	94.74	94.74	94.74	88.89	83.33
10 ⁻¹¹	90.00	90.00	90.00	90.00	94.74	84.21	84.21	88.89	88.89
Control	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
SE±	0.577		CD (0.05) ; 1.664		CD (0.01) : 2.238				

Central Sericultural Res. & Training Institute
Mysore 570 008, India

Kanika Trivedy, G. R. Shivakumar
S. B. Magadum, K. S. Nair, R. K. Datta

REFERENCES

- Akai, H. and Kobayashi, M. 1971. Induction of prolonged larval instar by the juvenile hormone in *Bombyx mori* (Lepidoptera : Bombycidae). *Appl. Ent. Zool.* 6 : 138-139
- Chowdhary, S. K., Raju, P. S. and Ogra, R. K. 1990. Effect of JH analogue on silk worm, *Bombyx mori* L. growth and development of silk gland. *Sericologia* 30(2) : 155-165
- Krishnaswami, S. 1979. New Technology of silk worm rearing. *CSR&TIBulletin* No. 3
- Sbrenna, G., Leis, M., Capelloz, Z. A. S. and Capellozza, L. 1992. Effects of ecdysteroids administration on nonspinning larvae of *Bombyx mori* (Lepidoptera, Bombycidae) *Redia* 75(1) : 189-202
- Shivakumar, G. R., Reddy, K. V., Magadum, S. B., Hussain, S. S., Benerji, A. and Datta, R. K. 1993. Effect of phytoecdysteroids on the larval development of the silk worm. *Bombyx mori* L. *International Symposium on Cellular and Molecular Aspects of Developmental Regulation*, held at Pune, India (27 November to 1 December 1993)
- Trivedy, K., Remadevi, O. K., Magadum, S. B. and Datta, R. K. 1993. Effect of juvenile hormone analogue, **Labomin** on the growth and economic characters of silk worm, *Bombyx mori* L. *Indian J. Sericulture* 32(2) : 162-168