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〈資 料〉

Influence of "Manta" on Some Economical Characters of Eri Silkworm, *Samia cynthia ricini* Boisdual

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Abstract

The "Manta"(Juvenile hormone analogue-Methoprene) was topically applied at 36,48 and 72 hrs after the fourth ecdysis to eri silkworm, *Samia cynthia ricini* with doses of 2.75 μg/m*l*, 4.0 μg/m*l* and 8.0 μg/m*l*. The eri silkworm responded to 2.75 μg/m*l* of "Manta" applied at 72 hrs after the fourth ecdysis, resulting in improvement of larval, cocoon, pupal and cocoon shell weights.

Key words : Manta, Juvenile hormone, Eri silkworm, Economical characters.

Introduction

The juvenile hormone analogues are widely used in practical sericulture in Japan to increase the output of silk(Akai, 1979). The juvenile hormone analogues are known to enhance the larval weight(Shimada *et al.*, 1979 ; Calvez, 1981 ; Krishnaswami *et al.*, 1981 ; Chen and Liu, 1972 ; Washida, 1984) and cocoon weight in *Bombyx mori*(Chang *et al.*, 1972 ; Murakoshi *et al.*, 1972 ; Akai and Shibukawa 1984 and Akai *et al.*, 1985) and *Corcyra cephalonica*(Roychoudhury and Chackravorthy, 1984, 1985 ; Mukhopadhyay and Roychoudhury, 1986) and cocoon shell weight(Kamada *et al.*, 1979 ; Krishnaswami *et al.*, 1981 and Akai and Shibukawa, 1984) and pupal weight(Kobari and Akai, 1978) in *Bombyx mori*. It was reported that treatment of AY-22-342-3(JHA) to the 5th instar larvae of *Philosamia ricini* Hutt resulted in prolongation of larval period by 6-24 days and failed to form cocoons(Awasthi, 1985). It was also reported that per oral administration of RO-10-3108/018(JHA) to the 5th instar larvae of *Philosamia ricini* Hutt resulted in larval mortality and naked larval pupal intermediates(Singh, 1990).

The above reports confirm that juvenile hormone analogues enhance the economical parameters in silkworm and *C. cephalonica*. An attempt has been made to study the effect of "Manta" a synthetic JHA on larval, cocoon, pupal and cocoon shell weight and cocoon shell ratio in eri silkworm, *Samia cynthia ricini* Biosdual and some findings are reported in this paper.

Materials and Methods

The juvenile hornmone analogue "Manta" was procured from Otsuka Pharmaceuticals, Japan and used in the present investigation. The experiment was implemented successively two times October to December, 1986 and the larva were raised at 24.8℃ and 63.6% R.H. Concentrations of 2.75, 4.0 and 8.0 μg/m*l* of Manta(JHA) were prepared by adding distilled water and applied topically on dorsal side of eri silkworm at 36, 48 and 72 hrs independently after the fourth ecdysis. There were four replications of 50 individuals for each treatment. Distilled water was topically applied at 36, 48 and 72 hrs to worms as distilled water control. Untreated control was also maintained. Observations were

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recorded on maximum larval weight, cocoon and pupal weight, cocoon shell weight and cocoon shell ratio. Mortality was not encountered in any of the treatments. The data obtained were statistically analysed.

Results and Discussion

The experimental results on the improvement of commercial characters of eri silkworm, *Samia cynthia ricini* by application of "Manta" are discussed below.

Larval weight :

The highest single larval weight was recorded in case of 4 μg/m*l* of Manta batch(6.655g) treated at 48 hrs after the fourth ecdysis while the lowest was recorded in case of 2.75 μg/m*l* of Manta batch (5.765g) treated at 36 hrs after the fourth edysis. The larval weight was 5.060g in distilled water control and 4.744g in untreated control. There was significant increase in the larval weight in all the treated batches, compared to the controls($p<0.05$)(Table 1).

Cocoon weigt :

The cocoon weight also responded significantly to the application of Manta. Heavy cocoons were recorded with 4 μg/m*l* of Manta(2.995g) treated at 48 hrs after the fourth ecdysis while light cocoons were encountered with 2.75 μg/m*l*(2.401g) treated at 36 hrs after the fourth ecdysis. The cocoon weight was 2.417g in distilled water control and 2.192g in untreated control.

Pupal weight :

The highest single pupal weight was recorded in 4 μg/m*l* of Manata(2.643g) treated at 48 hrs after the fourth ecdysis and the lowest was recorded in case of 2.75 μg/m*l* of Manta(2.130g) treated at 36 hrs after the fourth ecdysis. There was significant improvement of pupal weight by the treatment of Manta.

Cocoon shell weight :

Significantly heavy cocoon shells were registered by 2.75 μg/m*l* of Manta(0.306g) treated at 48 and 72 hrs after the fourth ecdysis and light cocoon shells were obtained with 2.75 μg/m*l* of Manta(0.256g) treated at 36 hrs after the fourth ecdysis(Table 1). There was significant improvement of cocoon shell weight by the treatment of Manta. The cocoon shell weight was 0.291g in distilled water control and 0.234g in untreated control.

Cocoon shell ratio :

The highest cocoon shell ratio was observed with 2.75 μg/m*l* of Manta (11.66%) treated at 48 hrs after the fourth ecdysis and the lowest in case of 8.0μg/m*l* of Manta(9.69%) treated at 36 hrs after the fourth ecdysis. It was 10.55% in untreated cont-

Table 1. *Influence of "Manta" on some commercial characters of eri silkworm, Samia cynthia ricini.*

Treatments (μg/m*l*)	Time of treatment after the fourth ecdysis (hrs)	Maximum larval weight (g)	Cocoon weight (g)	Cocoon shell weight (g)	Pupal weight (g)	Cocoon shell ratio (%)
Manta 8.0	36	6.165	2.821	0.272	2.539	9.69(18.09)
Manta 4.0	36	6.335	2.958	0.300	2.642	10.74(18.56)
Manta 2.75	36	5.765	2.401	0.256	2.130	10.74(19.09)
Manta 8.0	48	6.182	2.624	0.289	2.319	11.13(19.43)
Manta 4.0	48	6.655	2.995	0.286	2.643	9.65(18.05)
Manta 2.75	48	6.166	2.646	0.306	2.325	11.66(19.92)
Manta 8.0	72	6.220	2.837	0.302	2.523	10.53(19.27)
Manta 4.0	72	6.115	2.751	0.282	2.457	10.40(18.75)
Manta 2.75	72	6.546	2.914	0.306	2.590	10.55(18.89)
Distilled water control		5.060	2.417	0.291	2.167	11.87(20.10)
Untreated control		4.744	2.192	0.234	1.993	10.55(18.91)
SEM ±		0.172	0.141	0.014	0.144	NS
CD at 5%		0.491	0.402	0.040	0.411	

Angular transformed figures in paranthesis.
NS=Non significant.

rol and 11.87% in distilled water control. Manta did not cause appreciable change in the cocoon shell ratio.

The larval weight was improved by the application of ZR 515(Methoprene)(Shimada *et al.*, 1979 ; Chen and Liu, 1978 ; Calvez, 1981 ; Washida, 1984) and ZR 512(Hydroprene)(Krishnaswami *et al.*, 1981) in *B. Mori*. The present study also indicated the fact of Manta improving the gain in the larval weight in eri silkworm. The cocoon weight was improved by the topical application of methylene dioxyphenyl derivatives(Chang *et al.*, 1972) as well as by oral administration(Murokoshi *et al.*, 1972) in *B. mori*. The cocoon weight was enhanced by the administration of Manta(Akai and Shibukawa, 1984 ; Akai *et al.*, 1985) and by the administration of ZR 512(Krishnaswami *et al.*, 1981). The present study indicated that Manta enhances the cocoon weight in eri silkworm thus confirming the findings of other workers. The pupal weight was improved by the administration of Manta in silkworm(Kobari and Akai, 1978, 1979). Currently also there was an increase in pupal weight of eri silkworm treated with Manta. The cocoon shell weight was improved by the topical application of Manta(Kamada *et al.*, 1979 ; Akai and Shibukawa, 1984) and ZR 512 (Krishnaswami *et al.*, 1981) in silkworm, *B. mori* and in the present study also, the cocoon shell weight was increased due to application of Manta. It was reported that JH as prolonged the larval period of *P. ricini* and increased the larval mortality. The results of the present study indicate that treatment of Manta to the 5th instar larvae of *S. c. ricini.* did not prolong the larval period and did not induce the larval mortality and larval pupal intermediates.

It is stated that juvenile hormone is potent inhibitor of protein sysntesis. This growth retardation affects only the silkgland but not other tissues(fat bodies and other tissues). It is known that fibroin and sericin production directly depend on the RNA accumulation(both rRNA and tRNA) and production of RNA is mainly controlled by nuclear activity. In normal larvae DNA accumulates within two replication cycles during the 1st half of the 5th instar and reach a plateau after four days. The time needed to complete these two cycles was increased when larvae treated with JH in the early stage based on thymidine incorporation as well as on thymidine kinase and DNA polymerase activities. In JH treated larvae DNA content in not affected consequently the two DNA synthesis cycles which over-lapped in native larvae dissociate following an early JH application(Garel, 1983).

JH is a potent inhibitor of DNA synthesis and requires to be metabolized in the target tissues of silkgland in preference to the fat body. JH possibly binds to the active chromatin and therefore inhibit DNA synthesis. Early JH administration leads to drastic inhibition of RNA transcription over 2-3 days, depending on the dose and number of applications. Thus RNA synthesis resumes that the final amount of accumulated RNA is much higher than in control(Garel, 1983). All these events leads to the improvement of commercial characters such as larval, cocoon, pupal, cocoon shell weight in silkworm. As there were no work of Manta on *Samia cynthia ricini*, we may presume that whatever the hypotheses put forwarded on *B. mori* have relevance here.

The present study confirms that Manta produces beneficial effects on the economic traits at 2.75 μg/m*l* of Manta treated at 72 hrs after the fourth ecdysis producing significant improvement in larval, cocoon, pupal and cocoon shell weight in the eri silkworm.

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