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Hormonal Control of the Body-colour Change in Larvae of the Larger Pellucid Hawk Moth, *Cephonodes hylas* L. (2). Hajime Ikemoto (Tokyo Prefectural Isotope Research Station, Fukasawa, Setagaya, Tokyo 158) Received June 4, 1976. *Botyu-Kagaku*, 41, 192, 1976.

30. オオスカシバの体色変化に関するホルモン的制御（2）

池本 始（東京都立アイソトープ総合研究所，東京都世田谷区深沢） 51. 6. 4 受理

オオスカシバの幼虫からアラタ体を摘出すると終令末期にみられる暗赤色化を少しばかりはやめる．おなじような現象はアビエチン酸誘導体（methyl-6, 7-dioxo-5α, 10α-podocarpa-8, 11, 13-trien-15-oate）の経口投与によってもみとめられる．

The green larvae of *Cerura vinula* (Lep. Notodontidae) turn to dark red prior to cocoon formation. Bückmann[1] showed that decapitation is capable of evoking to accelerate reddening of the epidermis in *Cerura* larvae. Probably reddening of the epidermis in *Cerura* larvae may be prevented by juvenile hormone (JH) secreted from corpora allata. The larvae of *Cephonodes hylas* exhibit chromatic change similar to that of *Cerura* larvae. Author demonstrated that JH and its analogue ZR 512 suppress the dark reddening which occurs at the end of the last instar of *Cephonodes* larvae[2].

In this report, it was shown that extirpation of corpora allata accelerate the dark reddening in *Cephonodes* larvae. Furthermore, the effect of A-11, a derivative of abietic acid and kojic acid which have been known as anti JH agent on the dark reddening in *Cephonodes* larvae was reported.

Materials and Methods

Animals

The last instar larvae of *Cephonodes hylas* were used. The larvae were reared as described previously[3].

Oral administration of two chemicals

Kojic acid was obtained from Wako pure chemical Ind. Ltd., Osaka and A-11 (Methyl-6, 7-dioxo-5α, 10α-podocarpa-8, 11, 13-trien-15-oate)[5] was supplied by the courtesy of the Laboratory of Applied Zoology, Tokyo University of Education. A-11 had been donated to the laboratory from Mr. S. Murakoshi, Kanagawa Sericultural Experiment Center.

The appropriate amount of kojic acid and A-11 was dissolved in distilled water and acetone (Wako, special grade), respectively. And the leaves of Cape jusmine were dipped in these solutions for a few minutes. After dipping, the excess water containing kojic acid was shaked out from leaves and leaves dipped in A-11 acetone solution were dried in air to remove acetone, then these leaves were fed to *Cephonodes* larvae throughout the last instar in order to examine whether two test chemicals, kojic acid and A-11, accerelate the dark reddening which occurs at the end of the last instar or not. As control, the leaves dipped with distilled water and acetone, respectively, were fed to the larvae.

Results

Extirpation of corpora allata

Corpora allata were removed from the larvae 2 or 3 days after the last larval ecdysis. Sham operated larvae were not fed on the food grass, because allatectomized larvae did not take the food grass, being different from silkworm, *Bombyx*

Table 1. Effects of extirpation of corpora allata on the dark reddening in the last larval instar of *Cephonodes hylas*.

Days of operation after the last larval ecdysis	No. of larvae used	No. of dark reddening larvae at the following days after the last larval ecdysis 4	5	6	No. of larvae unchanged
Extirpated					
2	7	2			5
3	20	15	5		0
Sham operated					
2	8		1	1	6
3	20	6	10	4	0
Untreated	10	2	7	1	0

Larvae excluding untreated larvae were not fed on the food grass.

mori.

When extirpation was applied 3 days after the last larval ecdysis, many sham operated larvae became dark red 5 days after the last larval ecdysis whereas many allatectomized larvae became dark red 4 days after the last larval ecdysis. When operation was applied 2 days after the last larval ecdysis, many larvae were starved to death after a laps of about 10 days with no signs of dark reddening and pupation in both allatectomized and sham operated larvae. But, a few allatectomized larvae became dark red in colour 1-2 days faster than sham operated larvae (Table 1).

Oral administration of two anti JH agents

As mentioned above, it was demonstrated that corpora allata suppress the dark reddening which occurs at the end of the last instar of *Cephonodes* larvae. In *Bombyx mori* larvae, the administration of kojic acid or A-11 shows an effect similar to the removal of corpora allata or the ligation between head and thorax[4,5].

As shown in Figure 1, when 0.1% solution was used, A-11 accelerated dark reddening of larvae in the last instar 0.5-1.0 days faster than that of control larvae. But administration of kojic acid did not accelerate the dark reddening in the last larval instar within the range of application tested in the present experiment. Thus, A-11 is more effective than kojic acid as anti JH agent to *Cephonodes* larvae.

The green leaves dipped in A-11 acetone solution turned to dark in colour partially or on the whole. And *Cephonodes* larvae feed on darkened leaves likewise green leaves. It is, therefore, not clear whether premature colour change in *Cephonodes* larvae by A-11 administration is due to primary effect of A-11 or secondary effect through darkened leaves caused by dipping the leaves in A-11 acetone solution.

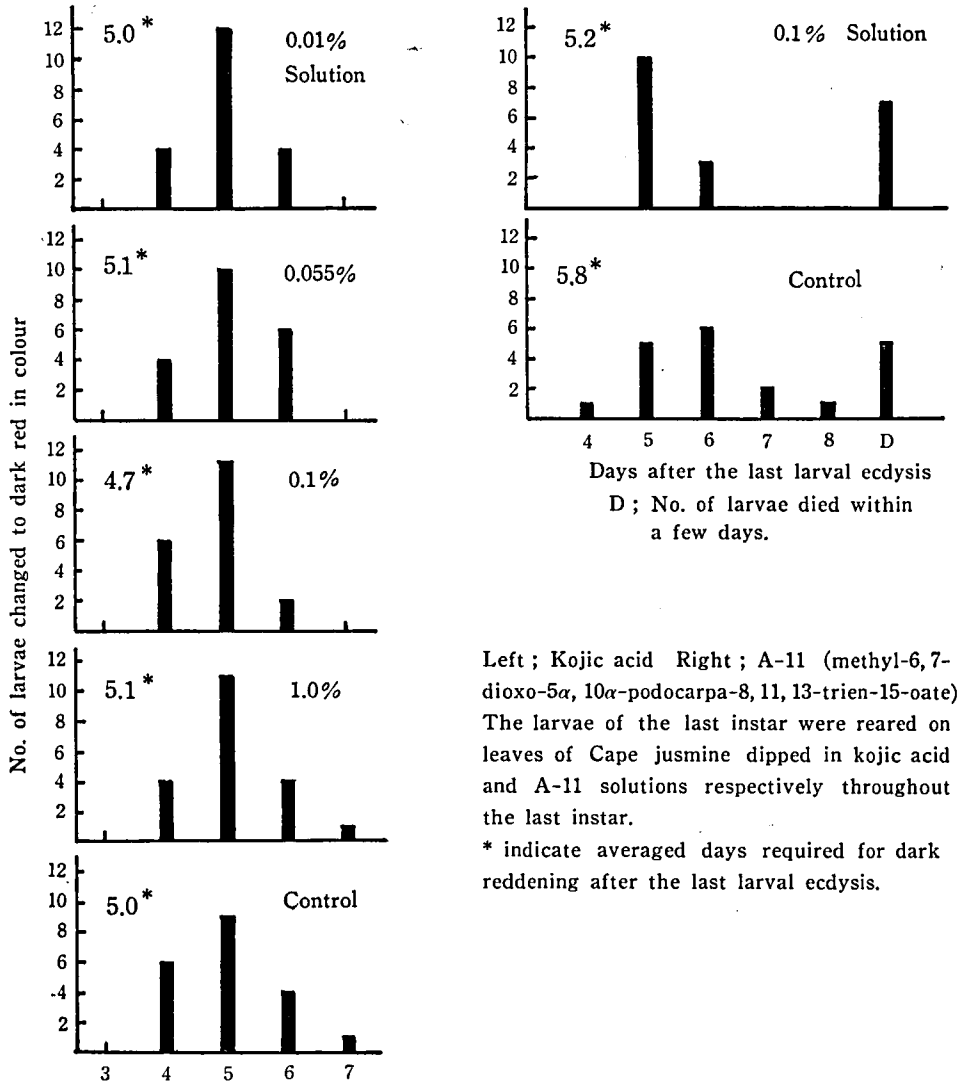
Discussion

From both the results reported in this paper and those previously issued that JH and its analogue ZR 512 suppress the dark reddening in *Cephonodes* larvae[2], it is evident that JH secreted from corpora allata is concerned with the inhibition of the dark reddening which occurs at the end of the last instar of *Cephonodes* larvae.

The dark reddening of *Cephonodes* larvae is dependent on the production of ommochromes in epidermis over the whole body and the formation of cuticular melanin at dorsal region (Ikemoto, unpublished data). It is, therefore, indicated that JH inhibits the formation of both ommochromes and melanin. This result provides a strong evidence to support the Hidaka's hypothesis[6] that corpora allata may participate in the formation of ommochrome pigments in the integument and it may control the action above-noted.

Summary

Extirpation of corpora allata slightly accelerated



Left ; Kojic acid Right ; A-11 (methyl-6, 7-dioxo-5α, 10α-podocarpa-8, 11, 13-trien-15-oate) The larvae of the last instar were reared on leaves of Cape jusmine dipped in kojic acid and A-11 solutions respectively throughout the last instar.

* indicate averaged days required for dark reddening after the last larval ecdysis.

Fig. 1. Effects of oral administration of two chemicals on the time required for dark red pigmentation in *Cephonodes* larvae.

the dark reddening which was observed at the end of the last instar of *Cephonodes* larvae. Premature colour change in like manner was also produced by oral administration of A-11 (Methyl-6, 7-dioxo-5α, 10α-podocarpa-8, 11, 13-trien-15-oate) to *Cephonodes* larvae.

Acknowledgement: The author is indebted to Mr. K. Kiguchi, Sericultural Experiment Station for his skilled technical assistance. Thanks are given to Dr. S. Yagi, Tokyo University of Education, who kindly sent A-11 to the author.

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