

The Effect of Cold Treatment on the Pupation and Emergence of the Mulberry Longicorn Beetle, *Apriona germari* Hope

Hyung Joo Yoon*, Young Il Mah and Jae Yu Moon¹

Department of Sericultue and Entomology, National Institute of Agricultural Science and Technology, RDA, Suwon 441-100, Korea.

¹School of Biological Resources and Material Engineering, College of Agriculture and Life Science, Seoul National University, Suwon 441-744, Korea.

(Received 4 October 2000; Accepted 4 November 2000)

To assess effects of cold treatment on pupation and emergence of the mulberry longicorn beetle, *Apriona germari*, the larvae, which ceased feeding, were exposed to three different temperature regimes (2.5, 5 and 7.5°C) and preservation periods (50, 80, and 110 days). The results indicated that pupation and emergence rates of *A. germari* were highest at 7.5°C for 110 days, 40.7% and 37.0%, respectively, demonstrating that the effect of cold treatment on metamorphosis was approximately 3 to 4 fold stronger than that of non-treatment.

Key words : Mulberry longicorn beetle, Cold treatment, Pupation, Emergence

Introduction

The mulberry longicorn beetle, *Apriona germari* Hope, is an important pest of mulberry tree in Korea. It is widely distributed in eastern Asia (Lee, 1987; Hua, 1982). *A. germari* larvae bore into the living trunk through egg-laying scars and fed on it (Yoon *et al.*, 1997). Also *A. germari* was reported to hibernate at egg or larval stage in the mulberry fields under the conventional management practice in Korea (Yoon *et al.*, 1997). It is very difficult to investigate ecological and physiological characteristics of *A. germari*, because it has a long life cycle, which takes approximately 2 to 3 years in wild fields (Zhang and Shen, 1980; Paik, 1987).

In a previous paper (Yoon and Mah, 1999) it was reported *A. germari* can be reared on the artificial diet in the laboratory conditions, shortening the natural life cycle for 2~3 years to approximately a year. A low rate of metamorphosis possibly takes place in the laboratory at room or higher temperature. More uniform pupation with a higher rate can be obtained by means of cold treatment of matured larvae (Galford, 1974; Hansen, 1990; Shimane and Kawakami, 1991).

Detailed information on how cold treatment affects pupation is not currently available for the mulberry longicorn beetle. An artificial rearing in the laboratory condition for *A. germari* was previously reported (Yoon and Mah, 1999), but the cold temperature condition of matured larvae does not exactly reflect the actual temperature conditions during the overwintering habitat.

The present paper compares the effect of temperature and preservation period for the cold treatment condition on *A. germari* and further on metamorphosis.

Materials and Methods

Insects

Larvae of *A. germari* were obtained from a colony, which has been maintained on an artificial diet in the laboratory for two generations (Yoon and Mah, 1999). The matured larvae, which ceased feeding, were randomly collected from the experimental groups and each larva was treated individually.

Cold treatment

Each larva was kept in the plastic container (8.7 cm in diameter and 2.0 cm in height). The matured larvae were divided into three groups and conducted at three different

*To whom correspondence should be addressed.

Department of Sericultue and Entomology, National Institute of Agricultural Science and Technology, RDA, Suwon 441-100, Korea. Tel: +82-31-290-8541; E-mail: hjyoon@rda.go.kr

Table 1. The effect of cold treatment on metamorphosis of *A. germari*

Temperature (°C)	Preservation (days)	Death (%)	Unmolted Larvae (%)	Pupation (%)	Pupal period (days)	Emergence (%)
2.5	50	59.3	18.5	22.2	19.0	18.5
	80	70.4	7.4	22.2	18.4	18.5
	110	62.5	8.3	29.2	19.3	25.0
5.0	50	55.6	11.1	33.3	20.1	29.6
	80	48.1	14.8	37.0	19.7	29.6
	110	67.9	7.1	25.0	19.8	25.0
7.5	50	48.3	17.2	34.5	19.8	34.5
	80	67.9	10.7	21.4	20.0	17.9
	110	51.9	7.4	40.7	19.4	37.0
Non-treatment*	-	62.1	27.6	10.3	19.3	10.3

*Non-treatment is continuously maintained at 25°C.

temperatures and preservation periods. The three groups of larvae were then cold treated in darkness under the following conditions: Group A: 2.5°C for 50, 80, or 110 days, Group B: 5°C for 50, 80, or 110 days, Group C: 7.5°C for 50, 80, or 110 days. After cold treatment, the larvae were incubated at 18°C for 1 day and transferred to a glass container (13.0 cm in diameter and 20.0 cm in height). Then they were kept at 25°C and under a photoperiod of 14L:10D. Pupation and emergence rates of each group were then examined.

Results and Discussion

The result of the cold treatments is shown in the Table 1. The pupation and emergence of *A. germari* under the three cold temperature conditions are shown. Pupation and emergence of the *A. germari* of non-treatment, however, were considerably lower. It apparently indicated that cold treatment was effective to metamorphosis.

In the lowest temperature condition (2.5°C), no difference in pupation and emergence rates was shown between preservation period of 50 and 80 days, but those kept for 110 days was slightly higher. Treatment at 5°C for 50 and 80 days was clearly effective in pupation and emergence than for 110 days, whereas treatment at 7.5°C for 110 days was high pupation and emergence. In treatment temperature only, treatments at 5°C and 7.5°C increased pupation and emergence, but treatment at 2.5°C was relatively lower. The difference in response of the treatment temperatures is not able to apparently explain but may reflect the interactions between diapause and adaptive temperature (Pullin and Bale, 1989). The pupation and emergence of *A. germari* were highest, when preserved at 5°C for 80 days and for 110 days at 7.5°C. These results implied that pupation and emergence rates are dependent on the temperature and cold preservation period (Shimane and

Kawakami, 1991). During the cold treatment, a number of *A. germari* died, approximately 50% at 5°C for 80 days and 7.5°C for 110 days, respectively. As already mentioned, pupation and emergence rates of *A. germari* was possibly increased by cold treatment as compared to those by non-treatment. Those rates are far behind the normal ones. Additionally, pupation and emergence of *A. germari* in the wild fields are unknown yet.

In this study, it was found pupation (40.7%) and emergence (37.0%) rates of *A. germari* were highest at 7.5°C for 110 days and were approximately 4-fold, and 3-fold, higher than that of non-treatment, respectively. Further, it possibly provides some informations on its diapause and adaptive temperature regimes for successive mass rearing of *A. germari* under the laboratory conditions.

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