

# The Loss of Weight in Insects<sup>\*</sup>

## III. The possibility of discriminating abnormal pupae of *Dictyoploca japonica* BUTLER from normal ones

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### INTRODUCTION

When the pupae of *Dictyoploca japonica* were infected with diseases or exposed to low relative humidities, some of them showed higher rates of weight loss continuously after a certain time (Ouchi & Suzuki, 1962, 1964). This fact suggests the possibility of distinguishing these pupae from normal ones by weighing. If we can apply this weighing method in practice with considerable accuracy, it would give us much convenience in conducting the experiment.

The present experiments were performed to determine the accuracy of this method. Here, it must be remembered that diseased pupae change colour sooner or later according to the species or progress of disease.

### MATERIALS AND METHODS

The larvae were divided into the following three groups.

Group I : Egg masses were collected in the field during the first decade of October, 1963, and kept in a desiccator containing water at a depth of about 2 cm. The lid of the desiccator was taken off during the egg period in order to maintain a suitable relative humidity. Then eggs were placed in an insectarium under room conditions until hatching. Larvae were reared on cherry leaves in a mass of 50 in a carton box (25×30×30 cm) during the first- and second instars, and at the beginning of third instar, each larva was transferred to a high petri dish and reared under similar conditions until pupation. After pupation, each pupa was kept in the same dish until emergence under the same conditions as those in the egg period.

Group II : Larvae derived from the egg masses used in group I. They were reared on cherry leaves in a group of 50 individuals in a carton box. When they reached full maturity, each larva was transferred to a high petri dish and kept under similar conditions as those for group I.

Group III. : Mature larvae were collected from the sumach tree in the field and each of them was also treated as same as in group I.

As it was thought to be desirable to weigh the pupa shortly before the critical time (Ouchi & Suzuki, 1962), weighing was made on some pupae at the 9th week after pupation to inspect the extent of weight loss. According to the extent of weight loss, each pupa was weighed twelve weeks after pupation.

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\* The title is changed from this report.

RESULTS AND DISCUSSION

The time of pupation, emergence and the duration of pupal stage are shown in Table 1. From the figures in Table 1, it is known that the weighing preceded the emergence for about 2—4 weeks.

Table 1. Food plants, time of pupation, emergence and duration of pupal stage.

Group	Species of food plant	No. of larvae	Time of pupation	Time of emergence	Duration of pupal stage (days)
I	<i>Prunus yedoensis</i>	28	June 6 ~24	Sept. 12~ Oct. 9	96~120
II	<i>Prunus yedoensis</i>	29	June 3 ~19	Sept. 19~ Oct. 7	102~121
III	<i>Rhus Javanica</i>	15	June 22 ~ July 8	Sept. 26~ Oct. 18	92~115

At the time of emergence, adults and pupae were divided into three different types as A, B and C according to the following definition.

Type A. The normal adult.

Type B. The deformed adult ; wings were not extended and the abdomen was long and plump for a long time until after death. It had failed to exuviate the puparium and to assume the correct posture.

Type C. The dead pupa : death was caused by the infection of disease.

In this experiment, the parasitised pupa was not found. The per cent decrease from initial weight is shown in Table 2.

Table 2. Percentage weight loss in pupae of type A, B and C from initial weight at the 12 th week after pupation.

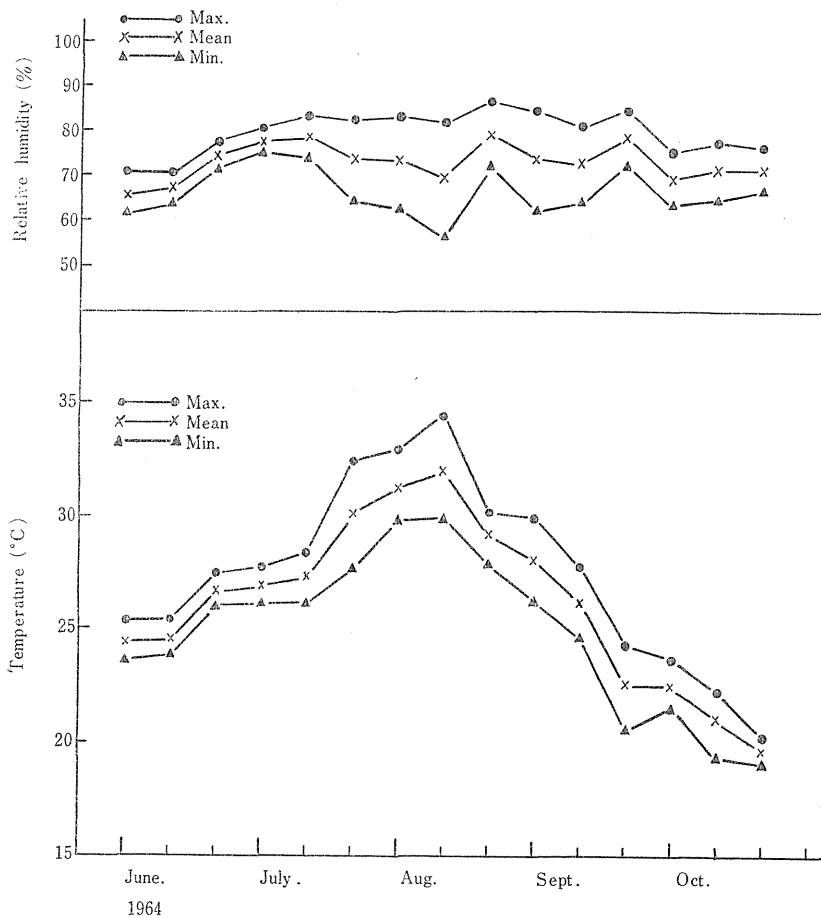
Group	Type	No. of pupae used	Percentage weight loss from initial weight													
			0	5	10	15	20	25	30	40	50	60	70	80	90	
I	A	14		8	5	0	1									
	B	4			1	1	1	1								
	C	10				2	1	1	1	2	1	1	0	1		
II	A	11		3	8											
	B	7		3	4											
	C	11		2	3	1	1	1	0	1	0	0	1	1		
III	A	7		1	6											
	B	4		1	1	1	1									
	C	4								1	0	1	2			

As shown in Table 2, the rate of weight loss varied from 5 to 25% in Type A, from 5 to 30% in Type B and from 5 to 90% in Type C. As for the pupae that belonged to Type B and C, not all of them exhibited higher rates than that of normal ones. Consequently, it is

not possible to distinguish all these pupae from normal ones by weighing only once in pupal stage. However, it can be said that the abnormal pupae are those which show relatively higher rates of weight loss at any time in pupal stage.

The pupae of Type B were found in the previous experiment when they had been kept under 30°C and 45, 70% r. h. (Ouchi & Suzuki, 1964). And as some of them also showed relatively higher rates of weight loss, one of the deleterious effects which gave rise to this type was attributed to the excessive evaporation. It is reasonable to think that the pupae of Type B will increase in a hotter and drier summer.

Figure 1. Average daily temperatures and relative humidities in each interval



In Type C, those pupae which showed the rates above 40% had changed colour at the first weighing. Though the species of disease were not identified, they were supposed to be a virus infection or the white muscardine. The average daily temperatures and relative humidities in each interval are shown in Figure 1.

### SUMMARY

An investigation was made on the possibility of distinguishing the abnormal pupae from

normal ones. Pupae used were those pupated from larvae reared under room conditions. Each pupa was weighed twelve weeks after pupation and the percentage weight loss from initial weight was calculated. At emergence, insects were divided into three types as A, B and C, representing the normal adult, the deformed adult and the dead pupa respectively. Though some of the pupae that belonged to Type B and C showed relatively higher rates of weight loss, others did not. So we can not distinguish all the abnormal pupae from normal ones by weighing. It can be said that those pupae that exhibit relatively higher rates of weight loss at any time in pupal stage are abnormal.

#### REFERENCES

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#### 摘 要

### 昆虫の体重減少について

#### 第3報 クスサンの不健全な蛹を体重減少率によって除去することの可能性について

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クスサンの蛹は、罹病したり高温乾燥の環境下におかれると、蛹期間中または羽化直後死亡したり不健全な成虫となる。これらの個体のあるものは、初体重に対する体重減少率(%)が、ある時期から比較的大になる。ゆえに蛹のある時期における体重減少率を求めて、不健全な蛹をどの程度除去出来るかを明らかにしようとした。

室内において幼虫をサクラ、ヌルデの葉を与えて飼育して蛹化させ、各蛹を秤量瓶の中に入れ蓋をとりはずしたまま実験室内に置き、羽化を待った。各蛹を蛹化後第12週目に秤量し、初体重に対する体重減少率(%)を求めた。羽化後各個体をA型(正常な成虫)、B型(不

健全な成虫)、C型(蛹期間中死亡した蛹)に分け、それぞれ体重減少率を比較した。その結果平均体重減少率はA型<B型<C型で、B、C型のある個体の体重減少率はA型の個体より大であったが、他の個体では差がなかった。ゆえに蛹期間中における体重減少率の相対的な比較によって、不健全な個体を全部除去することは不可能である。結論として、蛹期間中の体重減少率を相互に比較し、相対的に大きい値を示す個体の多くは不健全であるといえる。なお罹病蛹のある個体は、病菌の種類、病状の進行状況によって蛹期間中に変色するが、これも参考のため一緒に秤量した。昆虫による被寄生蛹は見られなかった。

\* 表題は本報より変更する。