

# The Loss of Weight in Insects

## VII. Influences of relative humidity on the weight of the eggs of *Dictyoploca Japonica*

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### INTRODUCTION

This species pass the winter in the egg stage. The eggs are laid in masses of 50~200, usually on the trunk of the chestnut or walnut tree at the heights of 2~3 m. They are dark-brown, attached to the bark tightly and stuck to each other closely without any covering. So they are exposed to the environmental conditions as long as 8 months from September to April.

The experiments were conducted to investigate the influences of relative humidity on the weight of eggs together with the rate of hatching.

### MATERIALS AND METHODS

The eggs were collected from the field at the beginning and middle of October 1964. Individual eggs of masses were separated from each other and these eggs were divided into groups of 20. Then each group was weighed and placed in a glass dish (inner diam., 2.6 cm) on 6th November. At each of 7 constant relative humidities ranging from 42 to 100 % and in one control plot, 4 groups were kept at room temperature soon after the initial weighing.

The given relative humidities were maintained by sulphuric acid solution contained in the desiccators (inner plate diam., 12 cm) at a depth of about 2 cm and the holes of the lids were loosely closed with absorbent cotton. The concentration of sulphuric acid solution was determined according to the daily mean temperature at a 10~15 day interval. During the course of the experiment, the influences of the fluctuation of daily temperature upon the relative humidity were neglected, because they were proved to be as being small (Willson, 1921<sup>5)</sup>).

After the initial weighing, the weighing was continued every other week until 30th April 1965. And later, the rate of hatching was examined.

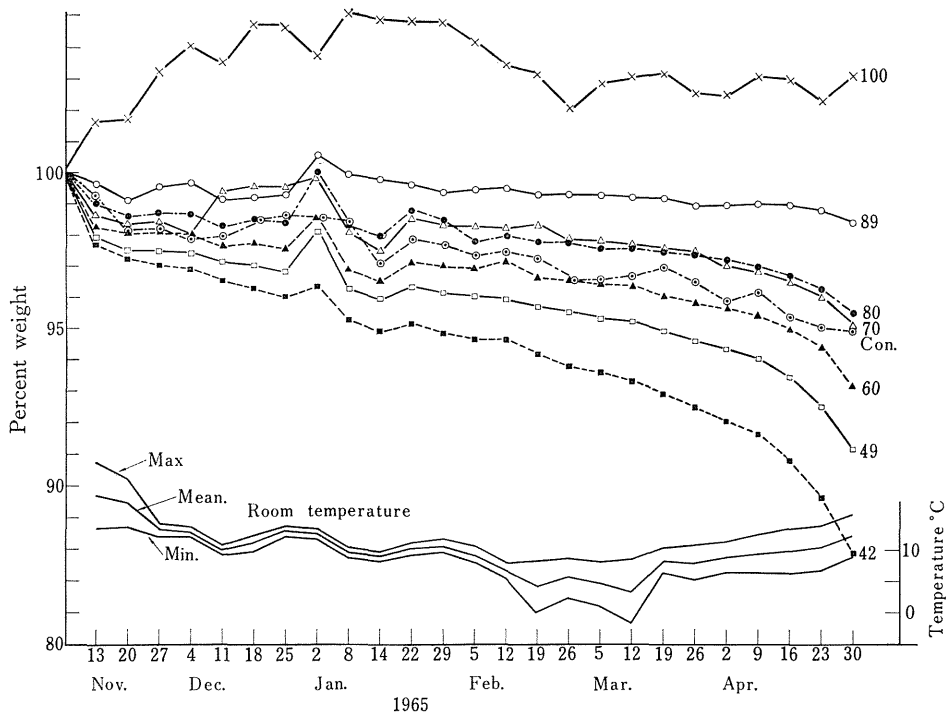
### RESULTS AND DISCUSSION

1. The changes in the weights of eggs.

The mean weights of groups at each relative humidity were expressed as percentages of initial ones and are shown in Fig. 1.

From the curves in Fig. 1, it is found that the percent weights at each relative humidity except 100 % R.H., decreased gradually until 30th April, when they showed the values ranging from 88 to 98 %. And the lower the relative humidity, the more rapidly the weight

Fig. 1. Percent weights of eggs kept at various gradients of relative humidity.



Note: The figures at the ends of curves denote the relative humidities.

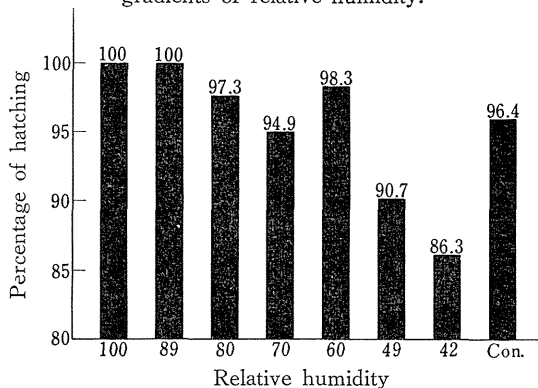
decreased. But sudden increases were observed twice or more between December and February. Whereas at 100 % R. H., the percent weights maintained the values above 100 % throughout the experiment and varied irregularly.

2. The rate of hatching

The hatching occurred from 13 to 16th March at relative humidities between 60 and 100 %, and from 13 to 19th at 42 and 49 %. So the time of hatching was retarded at lower relative humidities.

The mean rates of hatching of groups at each relative humidity are shown in Fig. 2. As shown in Fig. 2, they were very high showing the values ranging from 86 to 100 %, and

Fig. 2. Average percentages of hatching at various gradients of relative humidity.



became relatively smaller as relative humidity decreased. While that of control eggs showed about 96 %.

From the above results, it is suggested probable that the eggs have a capacity to prevent the excessive loss of water. And as to the reason of weight increase, either the production of metabolic water or the absorption of moisture from surroundings was considered to be attributable. Though we could not make clear the relations between the change in weight and the temperature concerned, during the diapause and post-diapause development.

In this respects, the water content of the egg during the embryonic development has been investigated by many workers. In the eggs of *Bombyx*, the sudden increases in the water content were observed three times during the embryonic development. And it was supposed to be due the metabolic water and its physiological importances were discussed in detail (Umeya, 1943<sup>4)</sup>). In the eggs of *Melanoplus differentialis*, water was absorbed chiefly during catatrepsis (Bodine, 1929<sup>2)</sup>), and in *M. bivittatus* during anatrepsis (Salt, 1949<sup>3)</sup>). Though in both species the increase in water content was interrupted during the diapause. On the other hand, in the eggs of *Austroicetes cruciata*, 40 % of the water was absorbed during the diapause development and 60 % during the postdiapause development (Birch and Andrewartha, 1942<sup>1)</sup>).

In the case of the eggs of *Dictyoploca japonica*, it is necessary for us to perform further researches on these respects.

#### SUMMARY

From November 1964 to April 1965, experiments were conducted on the influences of relative humidity on the weight and the rate of hatching of eggs of *Dictyoploca japonica*.

The eggs were collected from the field at early or mid October 1964, kept at constant relative humidities ranging from 42 to 100 % and weighed at a 7-day interval.

The weights of eggs at each relative humidity except 100 % R. H., decreased gradually until 30th April, when the percent weights ranged from 88 to 98 %. And the lower the humidity, the more rapidly the weight decreased. Whereas at 100 % R. H., the percent weights maintained the values above 100 % throughout the experiment. And between December and February, the increases in weight were observed twice or more.

The eggs hatched at mid March 1965 and the lower humidities retarded the hatching time for a few days. The mean rates of hatching at each relative humidity ranged from 86 to 100 % and became lower with the decrease of humidity. While that of control eggs showed about 96 %.

From the results, it was suggested that the eggs have a capacity to prevent the excessive loss of water.

#### REFERENCES

- 1) Birch, L. C. and H. G. Andrewartha: Aust. J. Exp. Biol. Med. Sci., **20**, 1 (1942)
- 2) Bodine, J. H.: Physiol. Zoöl., **2**, 459 (1929)
- 3) Salt, R. W.: Canad. J. Res. D, **27**, 236 (1949)
- 4) Umeya, Y.: Bull. Sericul. Exp. Sta, **12**, 447 (1943)
- 5) Willson, R. E.: J. Indus. and Engin. Chem., **13**, 326 (1921)

摘 要

昆虫の体重減少について

第7報 クスサン卵の重量に及ぼす各種湿度の影響

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クスサンの卵期間は9月初めより4月末まで8カ月間の長期にわたっている。この期間中における湿度環境に対する抵抗性を、重量の変化を測定することによって検討した。

クスサンの卵を10月初めに野外より採集し、11月初めに卵重をはかった後42～100%の範囲内の7種の恒湿区、室温下に置いた。その後は4月末まで7日ごとに卵重をはかり、さらにふ化率を調査した。

卵重は100%区を除いた各湿度区において徐々に低下して4月末には初卵重の88～98%を示し、標準区においては95%を示した。また卵重の減少速度は湿度が低くなるほど大になった。一方100%湿度区における

卵重は、実験期間を通じて初卵重の100%以上を保ち不規則に変化した。なお42～89%の各湿度区においては、1,2月中に2回以上の卵重の増加が見られ、この点について検討を加えた。

卵は各湿度区とも5月13日より同19日の間にふ化したが、低湿区におけるふ化期間は高湿区よりやや延びた。実験湿度の範囲内では、平均ふ化率は86～100%で湿度の低下に従って低下した。一方標準区のふ化率は96%を示した。

以上の結果からクスサンの卵は水分の過剰喪失を防ぐ能力があることがわかった。