SHORT COMMUNICATION

Osmotic Pressure and Water Content in the Bloods of Two Slug Moth Prepupae (Lepidoptera : Heterogeneidae)¹

A species of slug moth, *Monema flavescens*, exhibits a frost resistance characteristic in the prepupae stage (AOKI and SHINOZAKI, 1953 a, b; ASAHINA, 1966). On the other hand, AOKI (1964) found that the overwintering prepupae of *Scopelodes venosa*, which is closely related with *Monema* as a member of Heterogeneidae, is non frost-resistant. The principal mechanism of frost-resistance has become clear in the prepupae of the slug moth (ASAHINA, 1961, 1966; TAKEHARA, 1966).

In the case of *Monema*, it has been emphasized that the blood plays an important role in the process of freezing. The freezing of the prepupae starts from the blood and the ice formed grows on the outer surface of the tissue cells from which water is deprived. With the advance of blood freezing, the tissue cells undergo more dehydration, which may play a role in preventing the progress of freezing into the cells. In other words, it has been believed that the ice formation occurs only in the blood of the frozen prepupae and does not occur in the tissue cells themselves (ASAHINA, 1953, 1966; SHINOZAKI, 1954, 1962). From these reasons, the role of the blood on frost-resistance is very important.

A preliminary experiment was carried out to compare the blood in the prepupae of *Monema*

and *Scopelodes*. As shown in Table 1 the blood in the prepupa of *Scopelodes* is somewhat higher in the water content and lower in the osmotic pressure than that of *Monema*. The data in the table also denote that the blood of the former insect contains less amount of a transient substance which becomes eliminated at 105°C. These facts indicate that *Scopelodes* has a diluted blood. However, it is doubtful, as has been believed in *Monema*, that water is deprived more and more from the tissue cells with the advance of freezing, because the *Scopelodes* prepupa is non frost-resistance. On the other hand, there is a possibility that the tissue cell in *Scopelodes* has the character of low permeability to water. In such cases, dehydration of the tissue cells will remain in an inadequate state for freezing when the prepupa is solidified by freezing. Consequently, intra-cellular freezing, which is believed to be fatal for most insects, can easily take place through the process of inducing the frozen blood surrounding the tissue cells.

Although a large amount of blood is one of the conditions which break the supercooling quickly, the significant difference in the amount of blood is not found between in *Monema* and in *Scopelodes*.

It is well known that the concentration of amino acids and proteins contained in the blood not only inhibit the ice growth when the blood is frozen but also gives less chance for the ice crystals to come in contact with the protoplasmic membrane of the tissue cells. From these results, the protective action of concentrated blood from freezing seems to be higher in *Monema* than in *Scopelodes* at the overwintering period.

It has been considered that supercooling in insects is not controlled by blood concentration (ASAHINA, et al., 1954; HOLLSTEIN, 1947). On the contrary, it is not always necessary to conclude such a theory, because the data showed higher concentrations of blood and osmotic pressure of *Monema* than that of *Scopelodes*.

From such stand points further study is desired to make clear what states of tissue cells correspond to the solidification of these insects by freezing.

Table 1. OSMOTIC PRESSURE AND WATER CONTENT IN
THE BLOODS OF THE PREPUPAE OF
Monema flavescens AND
Scopelodes venosa

	<i>Monema</i>	<i>Scopelodes</i>
Osmosis (Berger method)	0.6-0.7 M KCl equivalent (yellow)	0.4-0.5 M KCl equivalent (orange)
Water content		
Desiccation with acetone at 38°C	76.04 ± 1.226* (pale pink yellow)	79.60 ± 1.327* (pale brown)
Desiccation at 105°C	78.75 ± 1.669* (pale orange brown)	80.68 ± 1.450* (dark brown)

*, 7 estimations at 95% confidence level.

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