Organogenesis stages.

Organogenesis in insect embryo was including differentiation of body segments and growth of embryo. The fifth day embryo of A. atlas has reached the organogenesis stage, and the organogenesis continued to the 7th day. According to Sander et al. (1985), organogenesis could be started during late germ band stage and it takes several days or even weeks depends on specific mechanism and characters of each insect egg. The fifth day embryo of A. atlas showed the complete segmentation body, but the formation of appendages and differentiation of cephal section was not complete yet. The embryo has 3 thoracic segments and 8 abdominal segments. The embryo of B. mori reached the complete segmentation body in 6th day (Tazima 1978).

In the sixth day, the embryo of A. atlas reached the stage in which all appendages are formed, the thoracic legs are completely formed and so did the prolegs (abdominal legs). Three pairs of thoracic legs grow in three thoracic segments, while the prolegs are found in the 3rd, 4th, 5th, 6th, and last segment of abdominal segments. The section of cephal has also performed well. The cephal was consisted of 3 segments that performed maxilla, mandible, and labium (Figure 6). In this stage, the pigmentation at the cephal was beginning, while B. mori embryo begins pigmentation of the cephal in 8th day (Tazima 1978).

The seventh day old embryo has the same morphological structure with the larva, which make this stage of embryo is known as prelarva embryo or mature embryo. Besides pigments are formed in entire body (including epithelium and seta), the embryo also grow bigger than the 6th day. After reaching this stage the embryo is ready to hatch.

**Hatching**

A. atlas larva hatched in 8 days after oviposition by cracking the eggshell. Some insect embryo is used to crack the egg shell to hatch or hatch through the hatching line (Sander et al. 1985). Different from B. mori that hatched in 9 or 10 days after oviposition (Tazima 1978).

Temperature effect on embryogenesis

Insect embryogenesis was affected by many factors, such as: temperature, humidity, genetic, and oxygen consumption (Sander et al. 1985). As poichilotherm organism, temperature has a big effect to insect embryo development. The exposure of cold temperature could caused abnormal development even death to the embryo (Yamashita & Hasegawa 1985). But some insect in temperate region has ability to survive from the winter by suppressing the metabolism through diapauses. The univoltine B. mori was the common model to study the diapause in Lepidoptera (Umeya 1950). While the polyvoltine one was the common model of artificial hibernation. The embryogenesis of polyvoltine B. mori can be postponed in a month by refrigerating it in 5°C (Katsumata 1964).

A. atlas was polyvoltine and used to life in tropical region. The cold temperature exposure on 7 days old A. atlas embryo caused the unsuccessful hatching. No embryo of A. atlas could hatch after being stored in 10°C for several times (Appendix 2). In polyvoltine B. mori, the egg that would be preserved should reach the mature stage (ready to hatch) that was indicated by the appearance of dark blue dot in the eggshell (Katsumata 1964).

This unsuccessful hatching might be caused by the lack oxygen demand or dehydration because the embryo was wrinkle (Appendix 3). Although some embryo was preserved in Sucrose 0.5 M and NaCl 0.89% medium, it did not prevent the embryo from dehydration.

**CONCLUSION**

The embryonic development of Attacus atlas occurred in 7 days. The morphological observation showed that the embryogenesis could be divided as pre-organogenesis and organogenesis stage. The 1st to 4th day old embryo could not be observed by the stereo microscope and it may be occurred the cleavage to gastrulation stage, while the 5th to 7th day old has reached the organogenesis stage. The exposure of cold temperature caused unsuccessful hatching in A. atlas.
SUGGESTION

To observe the details of embryonic stage, observations are recommended to be done in every 3 to 6 hours. The serial slicing specimen with histological staining is recommended to observe the complete process of embryogenesis. The using of SEM (Scanning Electron Microscope) is recommended to study the embryo movement.

REFERENCES


Tazima Y. 1978. The silkworm; an important laboratory tool. Tokyo: Kodamsha LTD.

