カイコの絹糸腺内腔における絹タンパク質の移動速度

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Velocity of silk protein movement in the silk gland of the silkworm, *Bombyx mori* L.

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小林初美・川上敏行・小林 勝・田中一行：カイコの絹糸腺内腔における絹タンパク質の移動速度

Regarding the silk protein movement in the silk gland of the silkworm (*Bombyx mori* L.), Nunome (1956) reported a current of liquid silk protein in the cavity. Later, using macroautoradiography, Fukuda and Florkin (1959) studied the movement of silk protein in the silk gland of fifth instar larvae. Akai (1963, 1976) observed the mobility of radioactive fibroin in the silk gland of ^{14}C-glycine-fed fifth instar larvae by microautoradiography. But the whole process of the liquid silk protein movement was not investigated.

This paper deals with the velocity of liquid silk protein movement in the fifth instar larvae of the silkworm, which was determined by macroautoradiographic method using radioactive amino acid.

Materials and Methods : Three-day-old, five-day-old, and seven-day-old fifth-instar larvae of silkworms (the hybrids between Reigyoku and Yoko), *Bombyx mori* L. were used. ^{14}C-DL serine was subcutaneously administered to larvae. The same amount of cold DL-serine was applied as controls. Then these larvae were fed on mulberry leaves without radioactivity.

At intervals of 3-108 hours after the administration, larvae were killed. The middle division of the silk gland (middle gland) was removed and fixed immediately in Bouin fixative solution at room temperature. Longitudinal sections, 100 μm in thickness, of the middle glands were cut at -15 °C according to the freezing method described by Tanaka *et al.* (1976). After being dried, sections were exposured to X-ray films (Sakura type N, Konishiroku Photo Ind. Co.) for 7 days at 4 °C. The films were then developed and acid fuchsin staining was carried out for observation of silk proteins (fibroin and sericin).

Results and Discussion : Appearance of silk protein in the middle gland :

As observed macroradiographically, the ^{14}C-serine administered into larvae was found in the middle gland (Fig. 1). When the ^{14}C was administered to three-day-old fifth instar larvae, the leading head of the radioactive silk protein (fibroin) was found in the posterior portion at the early periods (before 12 hours), and then the head moved to the middle and anterior portion of the middle gland. The appearance of radioactive serine administered to five- or seven-day-old fifth instars showed nearly the same pattern.

On the other hand, there was no radioactivity at all in the control autoradiographs made of specimens taken at each experimental interval.

We have already reported on the silk protein movement by autoradiography using ^{14}C-glycine (Tanaka *et al.* 1976). The investigation also revealed the movement of the silk protein as a function of time ; the fibroin moved starting from the inner layer of the posterior portion of the midd gland with a pattern appearing as a fine

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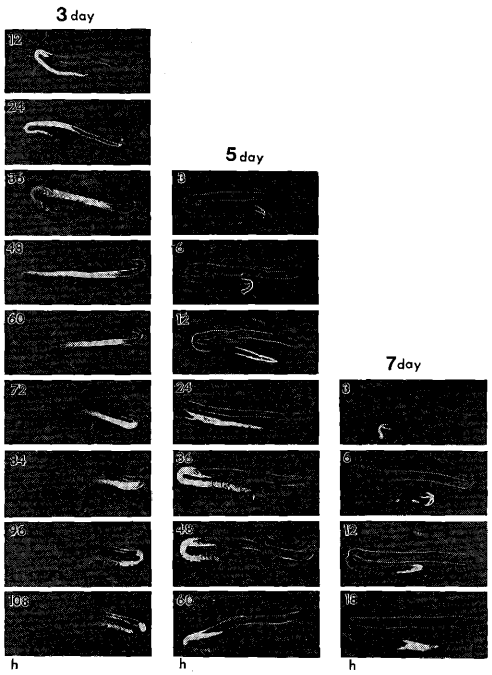

Fig. 1. Movement of the radioactive silk protein in the middle gland. The radioactive fibroin moved to the anterior area of the middle gland as a function of time.

parabola. Regarding the wave shape of the silk protein movement, Nunome (1956) had observed it and discussed the underlying mechanism. Our present results on the pattern of the silk protein movement were similar to those given in the aforementioned paper, but did not clearly demonstrate these patterns. One reason may be due to the comparatively thicker sections for macroautoradiography (Tanaka *et al.* 1976).

Velocity of silk protein movement :

As the individual middle gland was various in length, we estimated the relative location of the leading head to the whole length. The relative locations of the leading head of the ^{14}C-activity in the middle gland (Fig. 1) were measured as a function of time, and we got three curves indicating the relative location of radioactive silk

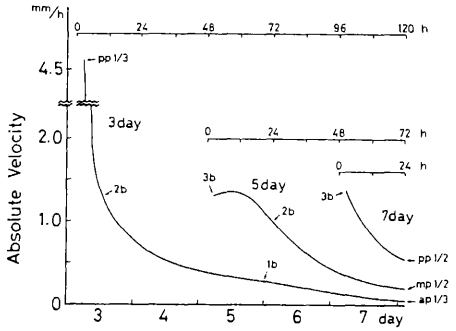

Fig. 2. Absolute velocity of the leading head of ^{14}C-activity in the middle gland. Three curves of the 3 day, 5 day and 7 day-old groups were drawn. ap : anterior portion ; mp : middle portion; pp : posterior portion ; 1b : 1st bending point ; 2b: 2nd bending point ; 3b : 3rd bending point.

protein in the middle gland. Based on the curves, we obtained the first derivative of these curves to generate three new curves showing the relative velocity of the silk protein movement in the middle glands. We measured the length of the middle glands, and got the absolute velocity of the silk protein movement in the middle glands (Fig. 2). The results clearly indicated that both relative and absolute velocity of the silk protein movement decreased as the label approached to the anterior area of the middle gland. Especially, the three-day-old group displayed the typical pattern.

References

AKAI, H. (1963) : Bull. Sericul. Exp. Sta., **18**, 190-197.

AKAI, H. (1976) : Ultrastructural Morphology of Insects, 57-113, Tokyo Univ. Press, Tokyo.

NUNOME, J. (1956) : J. Seric. Sci. Jpn., **25**, 25-28.

FUKUDA, T. and FLORKIN M. (1959) : Arch. Intern. Physiol. Biochem., **67**, 214-221.

TANAKA, K., KAWAKAMI, T. and TAKEDA, H. (1976) : J. Seric. Sci. Jpn., **45**, 7-12.