

SOME OBSERVATIONS ON MOVING PATTERNS OF THE  
VITAL SCOLEX OF *DIPHYLLOBOTHRIUM LATUM*  
(CESTODA : DIPHYLLOBOTHRIIDAE)

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Abstract

Vital observations on the expansive and the contractile movements of the scolex of *Diphyllobothrium latum* (Linnaeus, 1758) were described. The scolex has the responsible characteristics of the negative phototaxy to the artificial light, and the movements of scolex were promoted very much by the irradiation of the artificial light. The appearance of the scolex was converted into various forms shunning the light, and the apparent changes of the scolex in the moving processes were shown with some photographs minutely. Simultaneously, the importance in the preservative method of the diphyllbothriid cestodes was emphasized.

INTRODUCTION

Morphological structures of the cestode strobilae as well as the scoleces are supremely important for the specific identification in taxonomical studies. The scolex of cestodes is relatively small, elliptical, rod- or egg-like in shape, and situated at the apical end of strobila. The scolex has no function for ingesting the nourishing food, but it retains only the function for "holdfast organ" by which the strobila is anchored to the mucosa of the host intestine. In general, the external form of the cestode scolex falls into three broad groups such as the acetablate, the bothriate, and the bothridiate types from their morphological structures (Wadle et McLeod<sup>1)</sup>, Smyth<sup>2)</sup>).

The scolex of the raw individual just removed the host intestine often shrinks with several fixing fluids though an active movement of the scolex occurs when it is placed in the physiological salt solution. The opportunity to observe such movements of the scolex does not occur every day. The authors have encountered a patient infected with the common fish cestode of man,

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*Diphyllbothrium latum* in the Department of Medicine of our school. The patient evacuated a vital mature strobila with scolex of *D. latum* (ca. 360 cm in length) after being treated by the modified method of Damaso de Rivas (Kihara et al.<sup>3)</sup>). On this opportune occasion, the vital observations on movement of the scolex were carried out. The present authors would like to report here about the observation results on the expansive and the contractile movements of the scolex with some photographs.

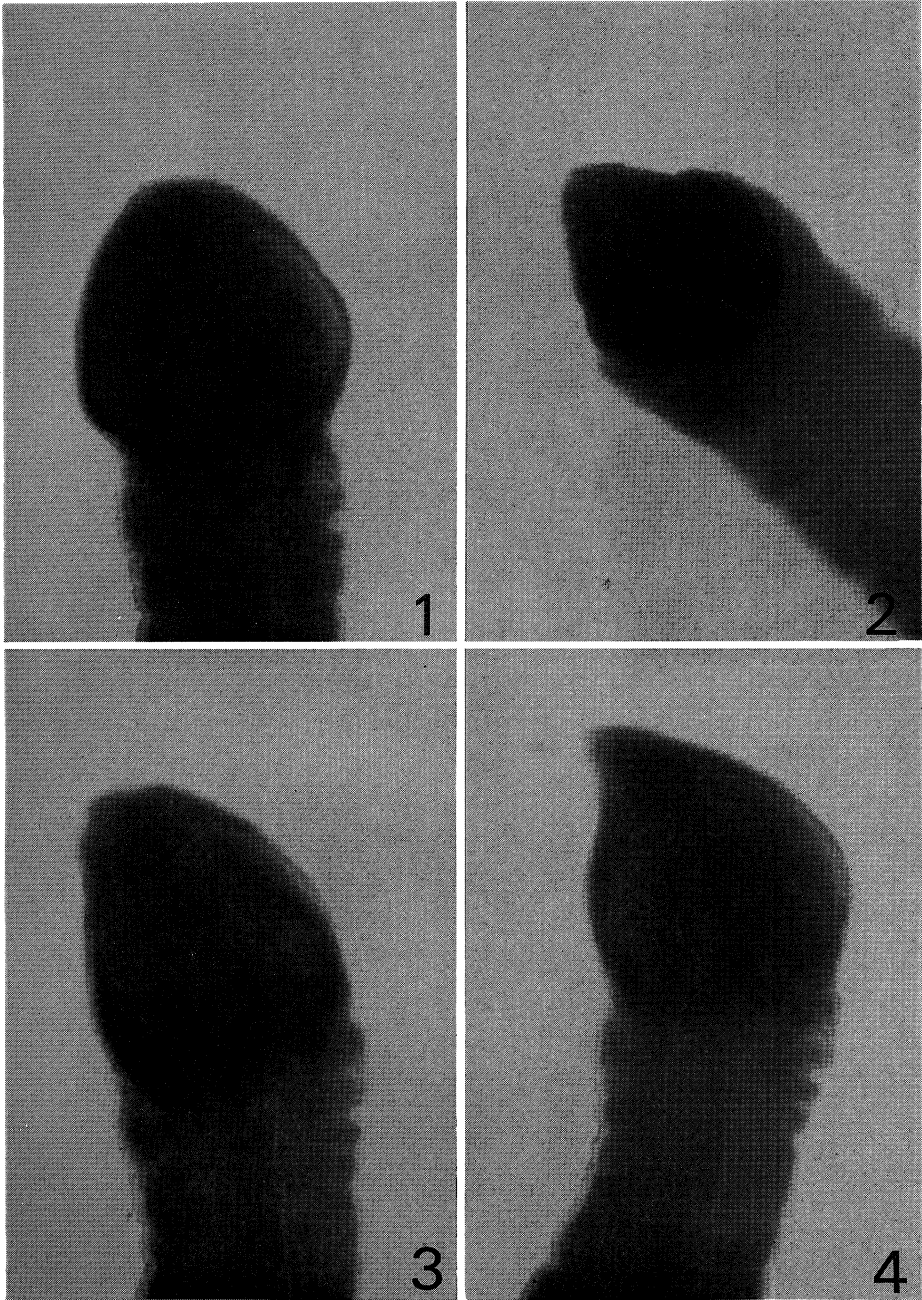
#### MATERIALS AND METHODS

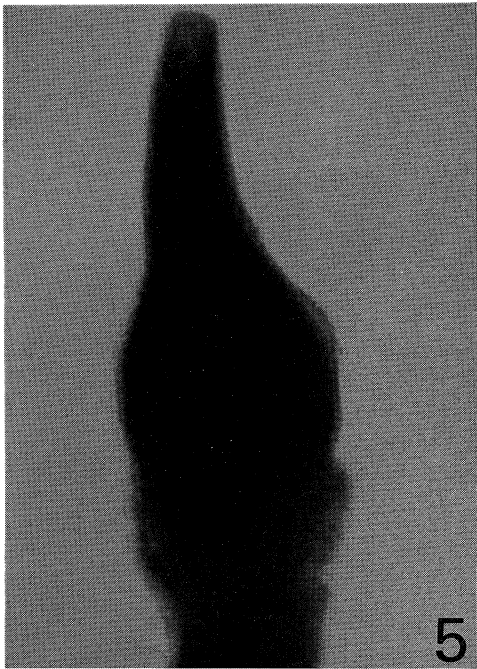
A mature strobila with scolex discharged from the patient was washed quickly in running water several times for removal purpose of the surface dirt, and the strobila transferred to a glass vessel with several amounts of the physiological salt solution for morphological examinations. The strobila began a slow movement for expansion and contraction of the whole body in the physiological salt solution. The movements of the scolex were observed under a microscope with no cover-slip at room temperature (about 20°C), and many photographs showing the expansive and the contractile movements of the scolex were made.

#### OBSERVATIONAL RESULTS

The vital strobila with scolex moved slowly in the physiological salt solution. The remarkable appearances in movement of the scolex are shown in Figs. 1 to 8. The scolex in a state of rest is almost spherical in shape, but is slightly an oblate, measuring about 1.3 mm in length and 1.4 mm in maximum width (Fig. 1). As the scolex of *D. latum* is included the bothriate type of cestode in taxonomical point of view, there are two bothria on the ventral and the dorsal surfaces of scolex (Fig. 2). If the apical parts of strobila are shone upwards using the microscopic light, a considerable change has come on its behaviors. The scolex shunned the light, and made a movement towards the dark positions in the glass vessel. The scolex taking refuge from the light became gradually triangular form (Figs. 3, 4), and the apical end of the scolex stretched towards darker position like elastic (Fig. 5).

The thoroughly stretched scolex is a rod-like in shape, measuring about 2.3 mm in length and 1.1 mm in maximum width. The apical end of full stretched scolex starts the expansion, and the scolex appears in the form similar to the stigma of pistil in the seed-plants (Fig. 6). When a uniform movement of the expansion is completed, the basal end of the scolex or the strobila including neck region begins a slow contraction towards the apical end of scolex after the expansion reaches its maximum, and then, the scolex





**Explanation of Figures**

Figs. 1-8. Photographs showing various forms in the expansive and the contractile movements of the vital scolex of *Diphyllbothrium latum* in the physiological salt solution. (Scale=1.0mm)

Fig. 1. Resting stage form of scolex, lateral view.

Fig. 2. Scolex slightly turned to the upwards, clearly showing ventral and dorsal bothria, apical view.

Figs. 3-4. Scoleces start to move in the opposite direction of a microscopic light, lateral view in each.

Figs. 5-6. Showing the apical end of scoleces expanding rapidly towards the forward, lateral view in each.

Fig. 7. Strobila advance slowly towards the apical end of scolex after the maximum expansion, lateral view.

Fig. 8. The motion of scolex gradually becomes slowly and finally stops after the complete contraction, lateral view.

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assumes a spatula- or rod-like form (Fig. 7). The contractile movements of the scolex are maintained from the time it starts to contract till the time of almost complete contraction (Fig. 8). Finally, the scolex returns to the resting stage form (Fig. 1). The scolex has been repeating the same movement some considerable times, and such behaviors seem to continue until the vital forces of worm are worn off.

**DISCUSSION**

It is well known that the external appearance of the scolex of diphyllbothriid cestodes differs very markedly by careful observations from different directions. In general, the vital strobilae as well as the scolex show a violent contraction of the musculatures by the effects of several fixing fluids. Especially, the scolex of diphyllbothriid cestodes is totally contracted, and the morphological disparity of scolex noted between fixed and non-fixed one has aroused much heated discussions. The scolex of *D. latum* in this paper contracted immediately after the individual had been preserved in a solution of 10 % formalin, and the appearance of scolex was substantially the same as that shown in Fig. 1. Total length of the contracted scolex was about 1/2 as compared with thoroughly expanded one. Judging from these phenomena, it can be assumed that use of high concentrated fixing fluid will cause still more contraction. As a matter of fact, the individual left for a long period of time under fresh raw conditions until the morphological characters of species disappeared from the musculatures of worm should be an exceptional case. The external form of the fixed scolex, on the other hand, will vary according to a wide variety of the fixing fluid, the concentration, the temperature, and other external effects. Therefore, the form of the fixed scolex seems to be greatly affected by the difference in the fixing fluid and manufacturing techniques.

To observe the external or internal characteristics of cestodes, the materials are most often kept in a solution of alcohol or formalin although due emphasis must be placed on differences by the special fixative method. The experiences of the authors suggest that the degree of contraction in the diphyllbothriid scoleces or strobilae is considerable high in a solution of alcohol than that of formalin except for the concentration. The use of such a variety of fixing fluids will intensify the change in the appearance of the scolex as observed by us with the vital scolex that underwent a remarkable change. There is not any definitive regulation with regard to the description of fixing fluid for the cestode individuals in recent use, and the investigators of tapeworm actually use various kinds of fixing fluid for individual preservation. Strictly speaking, it is incorrect, but it can not be helped with the present technical knowledge. The importance of the fixing techniques for the diphyllbothriid materials has been stressed by the cestode experts, such as Rausch<sup>4)</sup>, Stunkard<sup>5)</sup>, Iwata<sup>6)</sup> and Kamo<sup>7)</sup>. Recently, the problems of some criteria for specific identification of the diphyllbothriid cestode in Japan were discussed by Kamo<sup>7)</sup>, with particular emphasis on the skillful management of observable materials. It should be taken into account that the morphological structures of the diphyllbothriid cestodes suffer a remarkable change by the variety of fixing fluid. The appearance of the vital scolex showing multiple form will become more fixable in the definite form, if the fixing process for the diphyllbothriid cestode achieves the unity on the question.

#### REFERENCES

- 1) Wardle, R. A. and McLeod, J. A. : The zoology of tapeworms. New York and London, Hafner Pub. Comp. 1968, pp. 4-9
- 2) Smyth, J. D. : The physiology of cestodes. Edinburgh, Oliver and Boyd, 1966, pp. 15-17
- 3) Kihara, T., Kobayashi, R., Tsuji, O., Okazaki, S. and Kosaka, K. : Studies on large tapeworm. Part 3. Treatment of large tapeworm infections in man (*Taenia saginata* and *Diphyllbothrium latum*). Jap. J. Gastroent. **70** : 196-207, 1973 (in Japanese with English summary)
- 4) Rausch, R. : Studies on the helminth fauna of Alaska. XXI. Taxonomy, morphological variation, and ecology of *Diphyllbothrium ursi* n. sp. provis. on Kodiak Island. J. Parasit. **40** : 540-563, 1954
- 5) Stunkard, H. W. : Variation and criteria for genetic and specific determination of diphyllbothriid cestodes. J. Helminth. **39** : 281-296, 1965
- 6) Iwata, S. : Experimental and morphological studies of Manson's tapeworm *Diphyllbothrium erinacei* (Rudolphi) special reference with its scientific name and relationship with *Sparganum proliferum* Ijima. Progress of Medical Parasitology in Japan, Vol. IV, Meguro Parasitological Museum, Tokyo, 1972, pp. 533-590
- 7) Kamo, H. : Reconsideration on taxonomic studies of *Diphyllbothrium latum* (Linnaeus, 1758) in Japan with special record to species specific characters. Jap. J. Parasit. **27** : 153-142, 1978 (in Japanese with English summary)