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A Case of *Diphyllobothrium yonagoense* Infection

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=Abstract=A human case of *Diphyllobothrium yonagoense* infection was found by morphological study of a strobila recovered from a 65-year old man in March 1982. The patient, a seaside villager of Wando-gun, Chollanam-do (Province), revealed diphyllobothriid eggs (64-68 × 46-49 um in size) in his feces, and discharged a tapeworm strobila, 3.2 m long, after treatment with 40 mg/kg bithionol and purgation. The segments were characterized morphologically by parallel uterine loops, large thick-walled seminal vesicle, and thick-shelled eggs with deep pits, which were compatible with *Diphyllobothrium yonagoense* Yamane *et al.*, 1981.

Key words: ***Diphyllobothrium yonagoense, Human tapeworm infection, Marine fishes***

INTRODUCTION

Human diphyllobothriasis, chiefly caused by *Diphyllobothrium latum,* has been relatively uncommon but shows an increasing tendency in Korea (Lee SH *et al.* 1983 & 1987). Although the number of infected people may be much more, only 49 cases have been so far reported in the literature, either by recovery of eggs or by collection of strobilae (Lee SH *et al.* 1983 & 1987; Lee SK *et al.* 1987). Most of the cases were just regarded as *D. latum* infection, with no detailed consideration on its morphology and taxonomy.

The taxonomy of diphyllobothriid tapeworms has been intensively studied in Japan. As a result human infections with *Diphyllobothrium* species other than *D. latum* have been detected in more than 6 species (Kamo *et al.* 1981, 1982, 1988a & b; Kagei *et al.* 1987; Fukumoto *et al.* 1988). *D. yonagoense* Yamane *et al.* 1981 is one of those newly found, human-infecting species in Japan.

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The present authors re-examined a diphyllobothriid strobila expelled from a Korean fisherman in 1982 (case No. 3 of Lee *et al.* 1983), and found that it is consistent with the descriptions of *D. yonagoense* (Yamane *et al.* 1981; Kamo *et al.* 1988a).

CASE RECORD

The patient was a 64-year old man and a seaside villager of Kogun-myon, Wando-gun, Chollanam-do (Province). In March 1982, diphyllobothriid eggs, 64-68 × 46-49 um in size, were found in his feces during a screening stool examination. He was given 40 mg/kg single dose of bithionol, and purged with magnesium sulfate to collect the strobila. After 4 hours, a complete diphyllobothriid strobila, with scolex, was recovered from his diarrheal stool (Fig. 1). He had no special clinical symptoms related to this tapeworm infection. He said he used to eat various kinds of raw marine fishes collected from the sea near his village.

PARASITOLOGICAL DESCRIPTIONS

The strobila, with scolex and neck, was 3.2 m in whole length (Fig. 1), and composed of about 1,200 segments, the maximum width being 11.5

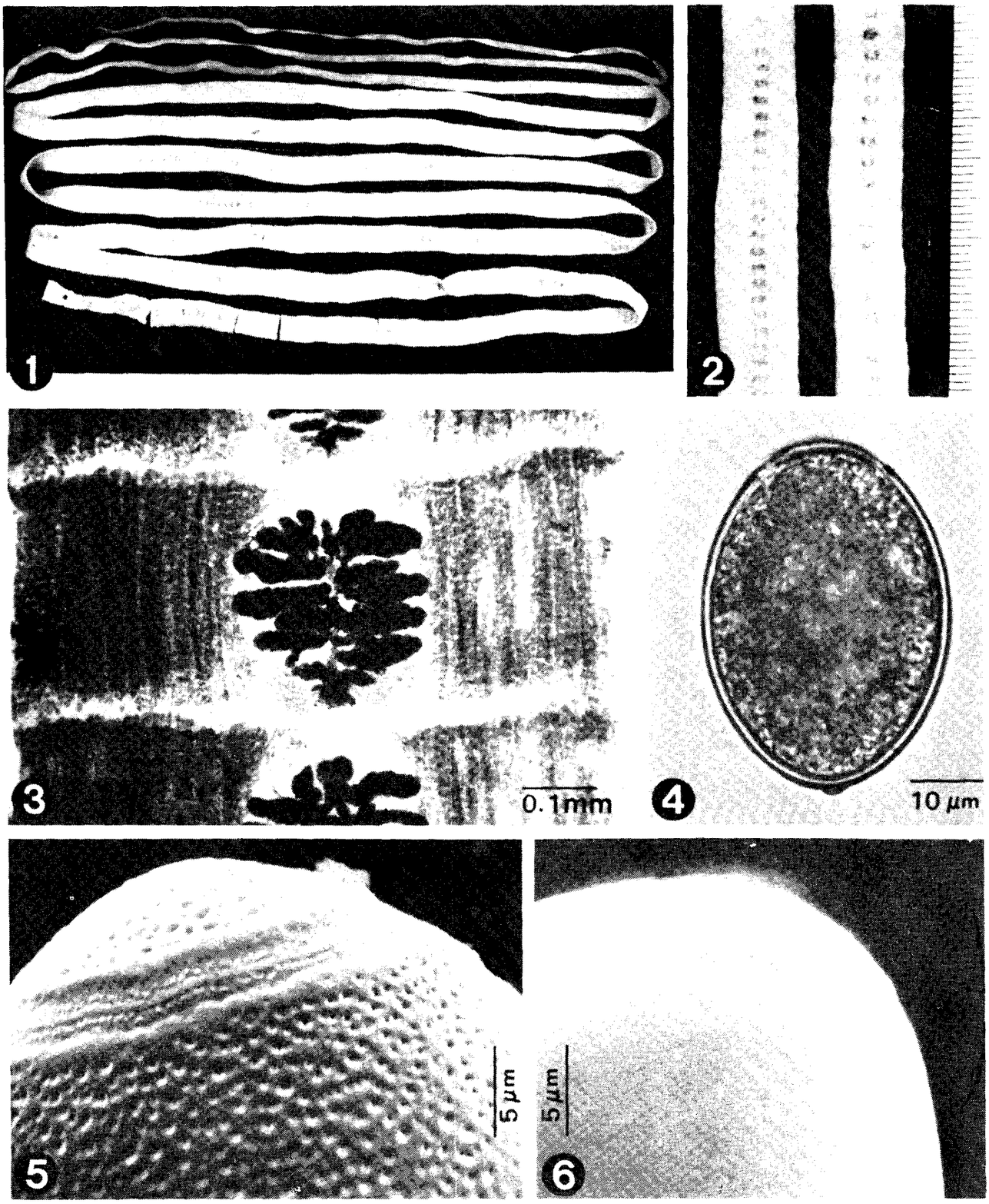

Fig. 1. Whole strobila of *D. yonagoense* recovered from the present case.
Fig. 2. Close-up view of gravid segments of *D. yonagoense* showing dark uterine fields and longitudinal striations.
Fig. 3. A gravid segment of *D. yonagoense* showing elliptical uterine field with 7-8 almost parallel uterine loops, two ovaries and a Mehlis' gland, and numerous longitudinal grooves at lateral fields. Acetocarmine stain.
Fig. 4. An egg of *D. yonagoense* showing relatively thick shell.
Fig. 5. SEM view of *D. yonagoense* egg, which reveals numerous deep pits.
Fig. 6. SEM view of *D. latum* egg showing inconspicuous pits.

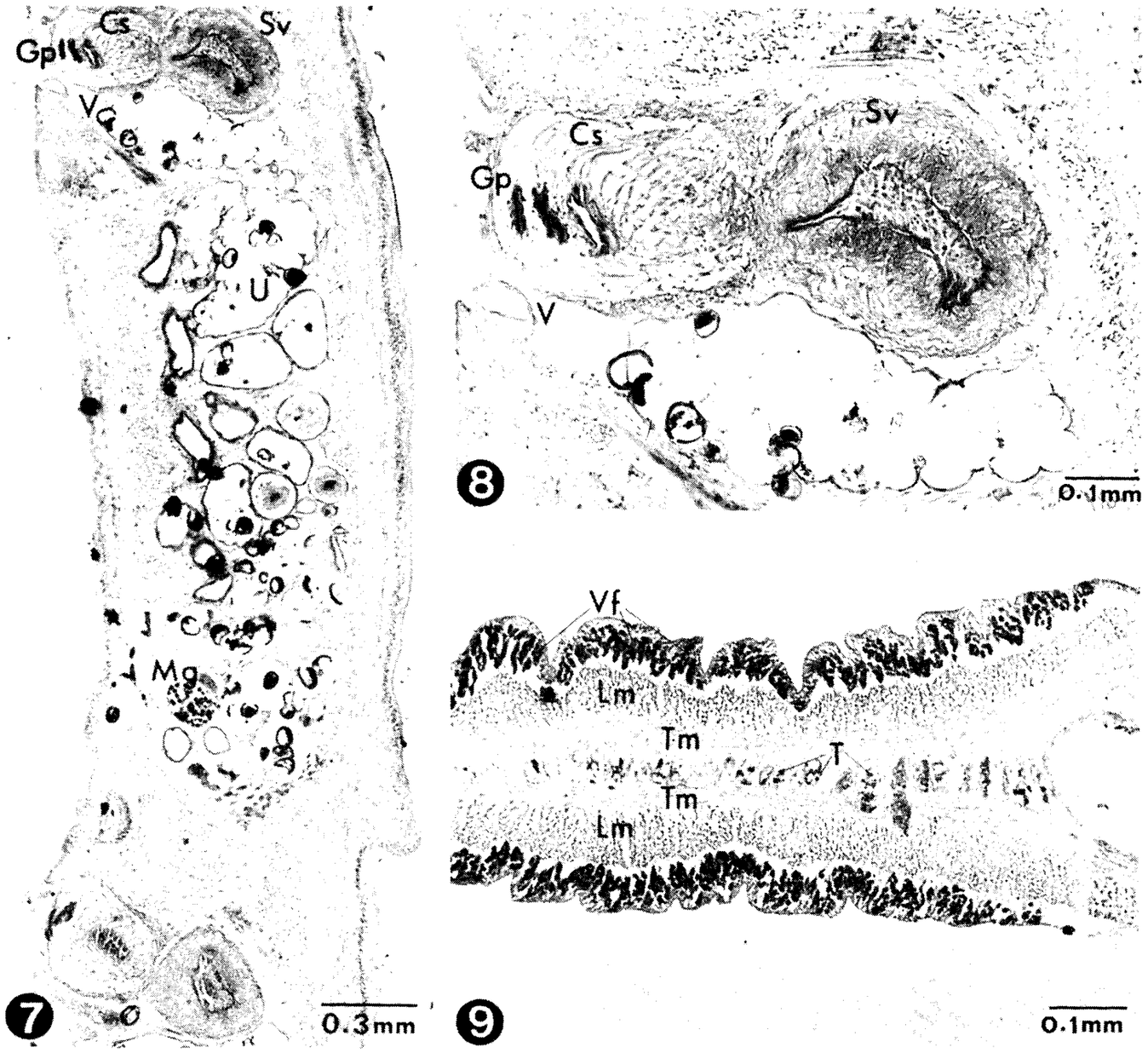

Fig. 7. A longitudinal section of gravid segments of *D. yonagoense* showing relationships of genital organs; seminal vesicle (Sv), cirrus sac (Cs), genital pore (Gp), Mehlis' gland (Mg), uterus (U) and vagina (V). H-E stain.

Fig. 8. High power view of Fig. 7 showing thick-walled seminal vesicle (Sv). H-E stain.

Fig. 9. A transverse section of middle portion of a gravid segment showing longitudinal muscles (Lm), transverse muscles (Tm), testis (T) and vitelline follicles (Vf). H-E stain.

mm (Fig. 2). The length/width ratio of pre-gravid segments was about 1:8, much wider than long, but in gravid ones the ratio became 1:4.5 and in terminal segments 1:3. Maximum thickness was 1.1 mm. It had many longitudinal deep grooves on the ventral and dorsal surfaces (Figs. 2 & 3). In each gravid segments, 7-8 parallel uterine loops were characteristically seen, forming an elliptical uterine field in the center of the segment (Fig. 3). Posterior to the uterine branches, two symmetrical dumbell-shape overies and a Mehlis' gland were seen (Fig. 3). Two sets of genital organs in a segment, reported by Yamane *et al.* (1981), however, were not found in the present specimen.

For detailed observation of uterine eggs, several gravid segments were destroyed with a pin and eggs were liberated. They were ellip-

soidal to oval with or without apical knob, 64.7-67.9 um long and 46.6-49.0 um wide (66.3 × 47.8 um in average)(Fig. 4). Egg shells were relatively thick, about 1.8 um. In scanning electron microscopy, the eggs of *D. yonagoense* showed numerous small and deep pits at their surface (Fig. 5), while those of *D. latum* (Lee *et al.* 1983) revealed only a few, shallow pits (Fig. 6).

In longitudinal sections of gravid segments, genital pore (Gp) was opened ventrally near the anterior 1/5 protion of each segment (Fig. 7). Cirrus sac (Cs) was pyriform, 0.33-0.37 mm long and 0.23-0.31 mm wide, and opened into the genital pore. Seminal vesicle (Sv) was large, spherical, 0.35-0.39 mm long and 0.29-0.31 mm wide, and connected to the cirrus sac almost right behind (Fig. 8). Its thick wall, 0.09-0.12 mm of thickness, was a characteristic feature. Vagina (V) ran anteriorly and then turned ventrally near the posterior wall of the cirrus sac (Fig. 7 & 8). Uterus (U) was sectioned into at least 7-8 parallel loops, with its pore at about 25% of segment length. Mehlis' gland (Mg) was observed near the posterior end (Fig. 7).

In transverse sections, two kinds of muscle fibers were observed; longitudinal (Lm) and transverse (Tm) ones. Abundant vitelline follicles (Vf) were distributed along the dorsal and ventral surfaces of each segment, and testes (T) were seen in deeper level than the transverse muscle (Fig. 9).

DISCUSSION

The present case was at first reported as a *D. latum* infection (Lee *et al.* 1983). However, re-examination of its morphology, both in whole mount and sectioned specimens, with scanning electron microscopy of eggs, revealed several characteristic features that are compatible with *D. yonagoense;* muscular body, 7-8 parallel uterine loops, thick-walled seminal vesicle, and thick-shelled eggs with deep pits.

The species, *D. yonagoense,* was first described based on a strobila expelled from a 41-year old man in Yonago city, Japan, as a marine species of diphyllobothriid tapeworm (Yamane *et al.* 1981). Two (Hirai *et al.* 1988) and three (Kamo *et al.* 1988a) additional human cases have been reported. However, there may be some more cases, since Kamo *et al.* (1988a) suggested that *D. yonagoense,* in broad sense, should include the "Koga-Okamura type" of *Diphyllobothrium,* originally described by Kamo *et al.* (1977). If their suggestion is accepted two other reports on "Koga-Okamura type" (Hasegawa *et al.* 1984; Kagei *et al.* 1987) should be regarded as *D. yonagoense* infection.

The importance of occurrence of *Diphyllobothrium* species other than *D. latum* in man is that those tapeworms probably are marine species of which life cycles are maintained in marine intermediate and final hosts. As for the "Koga-Okamura type", marine (coastal) fish, and marine mammals such as the dolphin, were suspected as its intermediate and final hosts respectively, although its exact life cycle is not known (Kamo *et al.* 1977). Final hosts of *D. yonagoense* were also suggested to be some kinds of marine mammals (Yamane *et al.* 1981). The source of infection in the present case is considered one of marine fish the patient consumed.

The deep pits observed on the egg shell surface of *D. yonagoense,* as in the present case (Fig. 5) and others, are a strong evidence that this tapeworm should belong to a marine *Diphyllobothrium* species (Hilliard, 1972). It is based on the finding that hatching, of diphyllobothriid eggs with deep pits as in marine species, greatly depended upon salinity rather than light, while hatching, of eggs with shallow pits as in fresh water species, depended upon light (Hilliard, 1972). The shell thickness as well as the size and shape of eggs can also be adopted as differential criteria of diphyllobothriid tapeworms (Maejima *et al.* 1983). However, Andersen *et al.* (1978) suggested that the size and shape of eggs should be affected by the kinds of host as well as the population of parasite within a host.

There is an increasing tendency of consuming raw marine fish in Korea. Therefore, attentions should be given to this type of marine *Diphyllobothrium* sp. infection.

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= 국문초록 =

*Diphyllobothrium yonagoense*의 인체감염 1례

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*Diphyllobothrium yonagoense*의 인체감염 1례가 1982년 3월 64세 남자 환자로부터 수집된 충체에 대한 형태학적 검토 결과 확인되었다. 환자는 전라남도 완도군 해안지방에 거주하는 어부로서 대변검사상 크기 64～68×46～49 μm인 裂頭條蟲類충란(diphyllobothriid eggs)이 검출되었다. Bithionol 40 mg/kg(1회)와 下劑를 투여한 바 頭節(scolex)이 포함된 총 길이 3.2 m인 충체를 회수할 수 있었다.

충체는 성숙편절(gravid segments)에서 좌우 나란히 뻗은 7～8個의 子宮枝(uterine loops)와 두꺼운 벽을 가진 貯精囊(seminal vesicle)이 관찰되며, 충란의 주사전자현미경 관찰에서 표면에 수많은 깊은 구멍(pits)들이 있는 점 등으로 *D. yonagoense* Yamane *et al.*, 1981으로 同定되었다. 환자는 여러 종류의 바다생선을 날로 먹어왔다고 하며 바다 생선이 감염원이었을 것으로 추측된다. 이 증례는 *D. yonagoense*의 국내 최초 인체감염이며 이러한 海洋裂頭條蟲類(marine diphyllobothriid tapeworm)의 우리나라 근해 분포를 의미하는 점에서 의의가 있다고 하겠다.