

## Infestation of *Colpoda*-like ciliate in the gills of yellowtail *Seriola quinqueradiata*

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In a survey of net-caged yellowtail *Seriola quinqueradiata* in the southern parts of Korean Peninsula, we found infestations of ciliate in the gills of the moribund fish during the abnormally elevated temperature. The ciliate was very similar to genus *Colpoda* Muller, 1773 on morphological and reproductive characteristics. Histopathological changes revealed that the ciliate invaded gills only, causing extensive destruction of the gill filaments including lamella without any clinical signs found in the other organs and tissues. This is the first record of the parasitic ciliate in cultured yellowtail.

*Key words*: *Colpoda*-like ciliate, *Seriola quinqueradiata*. Histopathology

Around 30 diseases, including four viral and nine bacterial diseases have so far been identified from the cultured yellowtail (Sako, 1992). A recent review of parasites on the cultured yellowtail deals with several protozoan parasites: *Kudoa amaniensis*, *K. pericardialis*, *Myxobolus buri*, *M. spirosulcatus*, *Microsporidium seriolae* (Arther and Ogawa, 1996). In comparison, parasitic ciliates such as *Cryptocaryon*, *Brooklynella*, *Uronema* spp. occurs more frequently in other marine fishes. A variety of free living ciliates including *Tetrahymena* spp. have been recorded in association with marine or freshwater fish (Hoffman, 1967; Hoffman et al., 1975). Yet no parasitic ciliates have been reported in the yellowtail.

In the course of disease survey of net-caged yellowtail in the southern coastal waters of Korean Peninsula, *Colpoda*-like ciliates were detected in the gills of the moribund fish. This is the first finding of a parasitic ciliate in yellowtail. The paper is to describe the histopathological changes of the affected fish as well as the morphological and reproductive characteristics of the ciliate.

### Materials and Methods

A survey for disease of cultured yellowtail *Seriola quinqueradiata* was conducted in the southern coastal areas of Korean Peninsula in June 1997. A total of 15 diseased yellowtails which exhibited a vertical swimming for outside water with opercula open or failed to swim were collected for pathological examination. Tissue samples were fixed in 10% neutral formalin, and histological sections were prepared and stained with Haematoxylin and Eosin using routine procedures: the Gimesa stain was used for demonstration of nucleus of ciliates: Bodian protogol method was used for determination of ciliation type of the ciliate. Ciliates were detected in the gill of additional moribund yellowtails by the light microscopic examination of wet mounts fixed with 5% formalin.

### Results

The moribund fish exhibited vertical swim for outside water with opercula open or went down to the bottom of the cage due presumably to the failure of swimming activity. Many an encysted ciliate were found in the gill filaments including lamella without any clinical signs found in the other organs and tissues (Fig. 1A).

The ciliates from the infected fish revealed three

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**Fig. 1.** *Colpoda*-like ciliate. A-D. Formalin fixed specimen. A. A gill filament of yellow tail showing encysted ciliate (arrow).  $\times 50$ . B. A spherical throphont type.  $\times 200$ . C. An ovoid encysted type. Note an empty area due to excystment of daughter cell (arrow).  $\times 200$ . D. A reniform excysted type (arrow).  $\times 200$ . E-F. Giemsa and Bodian stained specimen. E. A daughter cells showing a rounded macronucleus (n).  $\times 1000$ . F. An excysted ciliate showing dorsoventral flattening and vestibulum (arrow).  $\times 1000$ .

types of morphology (Fig. 1B, C and D). The spherical ciliate ranged from 120  $\mu\text{m}$  to 150  $\mu\text{m}$  in diameter. No cyst walls were observed in this type. The

encysted ciliates were ovoid and ranged from 150  $\mu\text{m}$  to 180  $\mu\text{m}$  in diameter, and they produced 4 daughter cells in a cyst. The daughter cell was

**Fig. 2.** *Colpoda*-like ciliate infects the gill of yellowtail. Giemsa stain. A. A marked necrosis showing the inter-lamella of gill.  $\times 200$ . B. Excessive mucus cell due to infestation of ciliate (arrow).  $\times 400$ .

nearly equalized in size and ranged from 70  $\mu\text{m}$  to 100  $\mu\text{m}$  in length. The daughter cell within a cyst had a simple rounded macronucleus, which was nearly half of the cell (Fig. 1E). The excysted ciliate, the daughter cell without cyst wall, was reniform with distinctive dorsoventral (Fig. 1F). The right body edge was convex, the left was concave. A somatic groove originated on the dorsal surface, traveled to the entrance of the vestibulum.

Histopathological change was only observed in the gills of the affected fish. The excessive destruction of the gill filament by the infestation of the ciliate was observed (Fig. 2A, B). Encysted ciliates were seen in the inter-lamella of the gills and caused marked necrosis in the epithelial cell and hyperplasia of mucus cell at the infected areas.

### Discussion

While a number of species of protozoan parasites have been described so far in the cultured yellowtail, no parasitic ciliates have been reported. The present study is the first record of parasitic ciliates

in yellowtail. The ciliate was clearly distinguished from the other hymenostome ciliates, particularly in morphology and reproduction. Its morphology and reproduction type strongly resembled with the genus *Colpoda* as previously described by Thomas (1954) and Carey (1992). However, we are not confident to make it sure that the ciliates found in the yellowtails are the genus *Colpoda*. The lack of comparable morphological features in the live specimens allowed us to assign only tentatively the ciliate belonging to the genus *Colpoda*.

In the present study, we could not find any pathological changes in the internal organ of yellowtails. Comparing with the histopathological changes described in other reports dealing with facultative parasitic ciliates, we found something similar features. Similar to our results, most of histopathological changes due to facultative parasitic ciliates happened in the external organ such as skin and gill (Hoffman, 1967; Migala and Kazubski, 1972; Cheung et al., 1979; Ferguson et al., 1987).

In the present study, we found that mortalities of yellowtails by the ciliate infestation occurred in a short period and subsequently subsided. During the survey, mortalities occurred in the yellowtail cages when water temperature abruptly increased up to 25°C from the expected 15-18°C, and the mortality subsided with the normalized water temperature. Cumulative mortality recorded about 50% during the 15 days infestation (data not shown). Similarly to our observation, Lom and Dykova (1992) reviewed that while infection by free-living ciliates occurred in adverse environment conditions, the infection rapidly disappeared under improved environmental conditions. In our survey, the infection of the ciliate species occurred by low dissolved oxygen concentration probably attributed to dramatic increase of water temperature in the net cage. With the increase of dissolved oxygen, the parasites disappeared.

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## 양식산 방어에 기생한 *Colpoda-like ciliate*

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섬모충류에 속하는 *Colpoda-like ciliate*가 양식산 방어의 아가미에 기생하고 있음을 국내에서 처음으로 기록하였다. 이 섬모충은 3가지의 형태(구형의 영양형, 난형의 피낭형, 방추형의 딸세포형)를 갖추고 있었으며 번식은 피낭내에서 4개의 딸세포형으로 이루어지는 것으로 조사되었다. 그리고 수직유영을 하는 방어의 아가미로부터 수많은 섬모충을 검출할 수 있었으며 이들 어류의 아가미 조직은 심각한 손상을 나타내었다. 그러나 체표를 비롯한 다른 조직에서는 이 섬모충에 의한 병변을 전혀 관찰할 수 없었다.

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