**Henneguya lateolabracis** sp. n. (Myxozoa: Myxosporea),
the causative agent of cardiac henneguyosis in Chinese sea bass *Lateolabrax* sp.

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**ABSTRACT:** A new myxozoan parasite was found from net-pen-cultured Chinese sea bass, *Lateolabrax* sp. in Japan. Diseased fish exhibited chronic mortalities with clinical signs of anemic gills and enlarged bulbous arteriosus. Irregular-shaped plasmodia developed in the bulbous arteriosus, with released mature spores accumulating in the lumen. Massive influx of spores into the gills caused local occlusion and congestion of gill capillaries, lamellar hypertrophy, and degeneration of the gill epithelium. Spores were ovoid with two equal caudal appendages. Average spore size was 10.7 μm in length, 7.5 μm in width and 6.2 μm in thickness. Average caudal appendage length was 37.7 μm. A new species name, *Henneguya lateolabracis*, is proposed as the causative agent of cardiac henneguyosis in Chinese sea bass.

**KEY WORDS:** Chinese sea bass, *Henneguya*, *Lateolabrax*, myxosporean, Myxozoa, new species.

**INTRODUCTION**

Since 1990, seedlings (juveniles) of Chinese sea bass *Lateolabrax* sp. also referred to as spotted sea bass, have been regularly imported to Japan from China for aquaculture. Recently, domestic production of seedlings by artificial insemination of Chinese sea bass has also started in Japan. Chinese sea bass was previously considered to be conspecific with Japanese sea bass *Lateolabrax japonicus*, but recent ichthyological and genetic studies indicated that Chinese sea bass is clearly a distinct species from the Japanese ones, although the scientific species name remains to be undesigned.1 Compared to Japanese sea bass, Chinese sea bass has a much greater tolerance to brackish or fresh water and a faster growth rate, suggesting that it is a favorable species for aquaculture. Recently, we found mortalities of net-pen-cultured Chinese sea bass caused by an unidentified myxosporean belonging to the genus *Henneguya*. In the present study we conducted parasitological and histological examinations of the diseased Chinese sea bass with the aim of identifying this parasite and describing the new disease.

**MATERIALS AND METHODS**

During 1998 and 2002, samples of diseased Chinese sea bass were provided for the University of Tokyo from fish farmers located in Ehime, Miyazaki and Mie prefectures of Japan. The origin of the seedlings was mostly China, but some were domestic. Standard lengths of the fish were 274–305 mm. After gross observation of diseased fish, infected tissues were freshly excised to examine spore morphology by light microscopy. Fresh spores were embedded in 1.5% melted agar and photographed with an oil immersion objective. A total of 0.2 mol/L KOH was applied to fresh spores to induce extrusion of the polar filaments, which were then measured. Smear preparations were made and stained with Diff-Quik (International Reagents, Kobe, Japan). Descriptions and measurements were made according to Lom and Arthur.2 Infected hearts and gills were fixed in 10% buffered formalin, and processed for histology. Paraffin-embedded tissues were cut at 5 μm,
RESULTS

Gross observations

Diseased fish exhibited anorexia and lethargy, leading to death. Disease outbreaks occurred from December in the year of seed introduction, and continued until June of the following year. During that period, chronic mortalities (approx. 0.2%/day) were found, and the cumulative mortality reached 4.7% at one farm site. Typical signs were anemia, increased mucus secretion in the gills (Fig. 1) and enlargement of the bulbus arteriosus. In wet mount preparations of the gills, large amounts of spores were found to occupy the entire region of the gill lamellae (Fig. 2), suggesting obstruction of the lamellar capillaries. The bulbus arteriosus was enlarged and distorted due to a mass of parasitic foci (Fig. 3).

Histopathological observations

Plasmodia developed in the adventitial and medial layers of the bulbus arteriosus (Fig. 4). Developing plasmodia were rounded or irregular in shape, present between the elastic muscle fibers and not encased by host connective tissue (Fig. 5). After maturation of the plasmodia, released spores accumulated in the lumen of the bulbus. In the gills, local occlusion of the blood vessels, congestion of the blood, lamellar fusion, branchial hyperplasia, and distortion of the gill filaments were observed (Fig. 6). Exfoliation and destruction of the gill epithelia due to spore-blocked capillaries were evident (Fig. 7).

Description of *Henneguya lateolabracis* sp. n.

Type-host: Chinese sea bass *Lateolabrax* sp. (Percichthyidae: Perciformes)
Type-locality: Mie Prefecture, Japan.
Site of infection: Bulbus arteriosus.
Spores (Figs 8,9): mature spores ovoid in frontal view with slightly attenuated posterior end. One sporoplasm present in the spore body. Two caudal appendages gradually tapering off, almost equal in size and separated along their entire length. Sutural ridges conspicuous with several folds on the edge. Two almost equal polar capsules pyriform in shape. Measurements were based on 20 spores from three infected fish (Table 1); spore length, 10.7 μm (9.9–11.9 μm); spore width, 7.5 μm (6.4–7.8 μm); spore thickness, 6.2 μm (5.9–6.4 μm); polar capsule length, 3.4 μm (3.0–4.0 μm); polar capsule width, 1.7 μm (1.5–2.0 μm); caudal
appendage length, 37.7 μm (30.7–49.5 μm); extruded polar filament length, 22.4 μm (15.9–26.7 μm). The number of turns of polar filament coil appears to be 3.

Type-material: syntype specimens deposited in the collection of the National Science Museum, Tokyo, Japan, accession no. NSMT-Pr178.

DISCUSSION

In the present study, a new species of *Henneguya* is described from the bulbus arteriosus of Chinese sea bass. So far a total of 146 species of *Henneguya* have been described from marine and freshwater fish.3 *Henneguya lateolabracis* most closely resembles *H. otolithi* in spore morphology and the site of infection (Table 1). However, spores of *H. otolithi* are thinner than those of *H. lateolabracis*, and have a characteristic thickening running transversely around the middle of the spore body.3 As well as *H. otolithi*, three species infecting the bulbus arteriosus and/or the heart of marine fish have been described (Table 1). However, the spores and caudal appendages of *H. sebasta* are significantly longer than those of *H. lateolabracis*.5 Spores of *H. vitiensis* are longer and the caudal appendage is shorter than in *H. lateolabracis*.6 *Henneguya yoffensis* spores are longer and wider than *H. lateolabracis* spores.7 Based on these morphological differences, *H. lateolabracis* is considered to be a new species.

Until now, little has been reported about the pathogenicity of myxozoans infecting the hearts of fish. Rajendran *et al.* documented a cardiac myx-
Fig. 8  Fresh spores of *Henneguya lateolabracis* sp. n. Bar = 10 μm. (a,b) Front views of spores. (c) Side view of spore.

Fig. 9  Diagramatic illustration of *Henneguya lateolabracis* sp. n. Bar = 10 μm.

<table>
<thead>
<tr>
<th>Species</th>
<th>Length (μm)</th>
<th>Width (μm)</th>
<th>Thickness (μm)</th>
<th>Length of caudal appendage (μm)</th>
<th>Width of caudal appendage (μm)</th>
<th>Hosts</th>
<th>Sites of infection</th>
<th>Locality</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>H. lateolabracis</em> sp. n.</td>
<td>10.7</td>
<td>7.5</td>
<td>6.2</td>
<td>3.4</td>
<td>1.7</td>
<td>Bulbus arteriosus</td>
<td>Lateolabrax sp.</td>
<td>Mie, Japan</td>
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<tr>
<td><em>H. otolithi</em> Ganapati, 1941</td>
<td>10–12</td>
<td>6–8.5</td>
<td>4–5</td>
<td>4.5</td>
<td>1.4</td>
<td>Otolithus ruber</td>
<td>O. maculatus</td>
<td>India</td>
</tr>
<tr>
<td><em>H. sebasta</em> Moser and Lowe, 1975</td>
<td>15.1</td>
<td>9.2</td>
<td>ND</td>
<td>3.2</td>
<td>1.7</td>
<td>Sebastes paucispinis</td>
<td>Sebastes paucispinis</td>
<td>California USA</td>
</tr>
<tr>
<td><em>H. vitiensis</em> Laird, 1950</td>
<td>13.7</td>
<td>7.8</td>
<td>ND</td>
<td>2.7–3.7</td>
<td>1.7</td>
<td><em>Leiognathus fasciatus</em></td>
<td><em>Leiognathus fasciatus</em></td>
<td>Fiji Islands</td>
</tr>
<tr>
<td><em>H. yoffensis</em> Kpatcha, Faye, Diebakate, Fall and Togutbaye, 1997</td>
<td>12–15</td>
<td>9.1</td>
<td>(3–4)</td>
<td>(4–11)</td>
<td>ND</td>
<td><em>Sparus caeruleostictus</em></td>
<td><em>Sparus caeruleostictus</em></td>
<td>Senegal</td>
</tr>
</tbody>
</table>

Table 1  Comparison of spore dimensions of *Henneguya lateolabracis* sp. n. with other related species.
osporiosis of pearl-spot, *Etroplus suratensis* caused by *Myxobolus etropli* developing in the bulbus arteriosus, but mortality and/or visible abnormalities were not observed in the infected fish. Although it is possible that heavy infections with *H. lateolabracis* may directly impair heart function, it is evident that the gills were significantly damaged by the massive influx of mature spores originating from the bulbus arteriosus. Hemorrhagic anemia during the recovery process of infected fish was reported in heavy infections with *M. artus*. After maturation of *M. artus* plasmodia in the skeletal muscle of common carp *Cyprinus carpio*, numerous spores aggregate in the gills causing destruction of the gill capillaries and exfoliation of the gill epithelia, finally leading to blood loss. In both cases the pathological changes accompanying spore discharge seem to be primarily due to the heavy load of spores in the gills, resulting in clinical disease.

It is of great concern that introduced exotic fish may have impacts such as ecologic competition with native fishes, genetic disturbance by cross-breeding, and translocation of exotic pathogens on the ecosystems of Japanese waters. The origin of *H. lateolabracis* is still unknown but it is possible that this parasite was transferred to Japan from China through the transportation of seedlings of Chinese sea bass. It is also possible that a new habitat for Chinese sea bass might favor infection with a newly encountered parasite, indigenous to Japan.

Seasonal occurrence of cardiac henneguyosis in cultured Chinese sea bass was empirically observed, but further studies should determine the prevalence of infection, developmental cycle of the parasite, and recovery phase (if present) of diseased fish. This epizootiological information may help in the management and control of this disease in Chinese sea bass.

In conclusion, this myxosporiosis of Chinese sea bass is considered to be an emerging disease associated with the introduction of exotic fish. We propose a new species name for the myxosporian, *Henneguya lateolabracis* sp. n. as the causative agent of cardiac henneguyosis in Chinese sea bass.

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