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Isolation of *Aeromonas salmonicida* from Masu Salmon in the Republic of Korea

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ABSTRACT: The isolation and identification of the Gram-negative fish pathogen, *Aeromonas salmonicida* *salmonicida*, from masu salmon (*Oncorhynchus masou*) at the Yang Yang Salmon Hatchery in the Republic of Korea is described. The bacterium possessed certain characteristics in common with isolates from fish in Japan. It is an important cause of mortality among cultured salmonids in the Republic of Korea. This is the first report of this fish pathogen from the Asian mainland.

Key words: *Aeromonas salmonicida* *salmonicida*, bacterium, fish pathogen, Republic of Korea, masu salmon, *Oncorhynchus masou*, case report.

Aeromonas salmonicida, the causative agent of furunculosis, is a widely distributed and important pathogen of fish, particularly salmonids (Winton et al., 1983). It is a major disease affecting the production of salmon and trout in hatcheries (Herman, 1968).

In November 1986, while examining groups of fish for viruses at the Yang Yang Hatchery in the Republic of Korea (ROK), *Aeromonas salmonicida* *salmonicida* was isolated from masu salmon (*Oncorhynchus masou*). Species reared at Yang Yang included rainbow trout (*Salmo gairdneri*), chum salmon (*Oncorhynchus keta*), *Brachymystax lenok* and masu. *Aeromonas salmonicida* was isolated only from the masu. The infected fish were approximately 35 cm in length, 3 yr old and had been received at Yang Yang as eyed eggs collected and shipped from the Samchock Hatchery, ROK in 1983. These eggs were derived from adults spawned in November 1983 at the Samchock Hatchery. Water for this hatchery is a spring which empties into the O Ship Chun (River), and there is no

record of furunculosis at this location. The water source for the hatchery at Yang Yang is the Namdae Chun (River) and contains both resident and migratory fish which could serve as carriers of *A. salmonicida* (Jensen and Larsen, 1980). The Yang Yang Hatchery is located near the town of Yang Yang on the east coast of the ROK approximately 12.5 km north of the 38th parallel (38°N). The Samchock Hatchery is also on the east coast of the peninsula near the town of Samchock approximately 45 km south of the 38th parallel.

Oncorhynchus masou is native to the ROK. These fish, referred to in Korean as kae song uh, are the same as the cherry or sakura masu in Japan. Additionally, the freshwater form of *O. masou* also occurs in the ROK and is referred to as sanchun uh. These fresh water masu are equivalent to the yamame in Japan. The fresh water masu at Yang Yang exhibited typical signs observed in fish with Gram-negative septicemia. Also, lesions of the type associated with *A. salmonicida* (abscesses) were present in the musculature of infected fish.

Aeromonas salmonicida *salmonicida* was isolated from the fresh water (non-migratory) form of masu in the ROK. Important characteristics of the organism are indicated in Table 1 and are compared with strain SS70, a well-characterized virulent isolate of *A. salmonicida* obtained from diseased chinook salmon (*Oncorhynchus tshawytscha*) in 1970 at the South Santiam Hatchery near the town of Foster in Linn County, Oregon, USA. The isolates from the ROK, like their counterparts in North America (1) produced a brown,

TABLE 1. Characteristics of the isolates of *Aeromonas salmonicida salmonicida* from the Republic of Korea compared to strain SS70, a typical virulent isolate from North America.

Characteristic	Isolate from ROK ^a	SS70 ^b
Morphology	Gram- rod	Gram- rod
Brown pigment	+	+
Motility	-	-
Gelatinase	+	+
Growth at 37 C	-	-
Growth at 25 C	+	+
Inositol	-	-
Mannitol	+	+
Sucrose	+	-
Arabinose	-	+
Glucose	+	+
Cytochrome oxidase	+	+
H ₂ S	-	-
Indole	-	-
Voges-Proskauer	-	-
Agglutinates with <i>A. salmonicida</i> antisera ^c	+	+

^a Three isolates of *A. salmonicida* from ROK were obtained from masu salmon at Yang Yang Hatchery and appeared identical.

^b South Santiam Hatchery, 43182 North River Drive, Sweet Home, Oregon 97386, USA.

^c Antiserum to strain SS70 was produced in young female white rabbits. The immunizing suspension contained 1×10^{10} cells/ml in complete Freund's adjuvant. One ml was injected either subcutaneously or intramuscularly at days 1, 15 and 50. Cells of these virulent strains of *A. salmonicida* exhibit autoaggregation. Agglutination of the cells with specific antisera was accomplished by comparison with appropriate saline controls. The speed of cell clumping in the presence of specific antibody exceeds autoaggregation reactions.

water-soluble pigment on trypticase soy agar and (2) were Gram-negative, non-motile short rods which grew optimally at 22–25 C and failed to grow at 37 C. It was determined by electron microscopy that both isolates had an A layer which is associated with virulence in this bacterium (Evenberg et al., 1982). Rabbit antisera against the known strain, SS70, produced rapid agglutination of the ROK isolates (Table 1). The isolates from the ROK were able to utilize sucrose while strain SS70 from North America was not. The fermentation of sucrose by the bacterium obtained from masu at Yang Yang is consis-

tent with that observed among many strains isolated in Japan (Kimura, 1969).

To our knowledge, this is the first observation of *A. salmonicida* isolated from diseased fish on the mainland of Asia. It has been isolated from a variety of salmonids in Japan and is well established throughout most of the trout- and salmon-producing areas of that country (Kimura, 1969).

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