1.2.4 *Edwardsiella tarda* Septicemia

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A. Name of Disease and Etiological Agent

The disease Edwardsiellosis is caused by *Edwardsiella tarda* (Ewing et al. 1965). Synonyms include: emphesematous putrefactive disease of catfish, red disease of eels, and Edwardsiella septicemia of salmon, tilapia, and striped bass.

B. Known Geographical Range and Host Species of the Disease

1. Geographical Range

Edwardsiella tarda is found in both freshwater and brackishwater environments. It has been reported from 25 countries in North and Central America, Europe, Asia, Australia, Africa, and the Middle East (Austin and Austin 1987).

2. Host Species

The bacterium has been isolated from over 20 species of freshwater and marine aquatic animals (Plumb 1999). Natural infections have been reported in channel catfish *Ictalurus punctatus,* carp *Cyprinus carpio,* goldfish *Carassius auratus*, largemouth bass *Micropterus salmoides*, brown bullhead *Ameiurus nebulosus*, chinook salmon *Oncorhynchus tshawytscha*, striped bass *Morone saxatilis*, freshwater eel *Anguilla japonicus*, tilapia *Sarotherodon niloticus*, red sea bream *Chrysophrys major*, and flounder *Paralichthys olivaceus*. Fish species that have shown susceptibility to laboratory challenge include: rainbow trout *Oncorhynchus mykiss*, yellowtail *Seriola quinqueradiata,* and Ioach *Misgurnus anguillicaudatus*. The bacterium also has been found to cause disease in a variety of other animals including seals, sea lions, porpoises, turtles, alligators, snakes, cattle, pigs, and birds. In humans, it causes acute gastroenteritis (Bockemuhl et al. 1971).

C. Epizootiology

In Japan, edwardsiellosis in eels occurs in the warmer months at temperatures near 30°C (Wakabayashi and Egusa 1973; Kuo 1977). In Taiwan, infections in eels can occur when water temperatures are fluctuating between 10 to 18°C in the spring (Liu and Tsai 1982).

Edwardsiella septicemia in most species of fish in the U. S. appears to be favored by high water temperatures (30°C and above), and the presence of high levels of organic matter particularly in catfish ponds. The prevalence of *E. tarda* infections is relatively rare in commercial channel catfish ponds and mortality rates are usually low (~ 5%) when it does occur. However, when infected fish are moved into confined areas such as holding tanks, mortality can reach levels as high as 50%. The reservoir of infection is unclear but the bacterium has been associated with a variety of aquatic invertebrates and aquatic and terrestrial vertebrates. Snakes or fecal contamination of water from human or animal sources may be a source of the bacterium. There is also some speculation that *E. tarda* may comprise a part of the normal microflora of the surfaces of certain fishes. In the U. S., *E. tarda* was isolated from as many as 88% of domestic dressed channel catfish and was found in 30% of imported dressed fish. The bacterium was also found in 75% of catfish pond water samples, 64% of pond mud samples, and 100% of frogs, turtles, and crayfish from catfish ponds (Wyatt et al. 1979).

D. Disease Signs

In channel catfish, the disease can occur as small cutaneous lesions that progress into large abscesses within the muscle (Figure 1 and Figure 2). These abscesses become filled with malodorous gas and necrotic tissue in chronic infections (Meyer and Bullock 1973). The most common manifestation in catfish and other species is generalized septicemia. In rare cases, clinical signs may mimic those of enteric septicemia of catfish caused by *Edwardsiella ictaluri* (Schwedler and Goodwin personal communication). In naturally diseased tilapia, clinical signs include loss of pigmentation, ascitic fluid in the abdominal cavity, and corneal opacity. Small white nodules may be present in the kidney, liver, spleen, and gills (Plumb 1999). Juvenile striped bass were reported to swim listlessly at the surface and exhibited pale gills. Histologically, the trunk kidney contained numerous abscesses (Herman and Bullock 1986). Eye disease has also been observed resulting in blindness in one or both eyes. In eels, two different pathological manifestations of the disease have been described: the suppurative interstitial nephritis form, characterized by abscesses in the kidney and the suppurative hepatitis form, characterized by ulcers and abscesses in the liver (Miyazaki and Egusa 1976a and b). Edwardsiella septicemia in eels is characterized by hemorrhagic fins, petechiae on the belly, swollen protruding anus, and necrotic foci in the internal organs (Wakabayashi and Egusa 1973).

E. Disease Diagnostic Procedures

Diagnosis is based on the observation of clinical signs consistent with the disease and isolation and identification of the etiological agent. Primary isolation should be made from the kidney on either blood agar or TSA and incubated at 30 to 35°C for 24 to 48 hours (Hawke 2000).

1. Presumptive Diagnosis

For presumptive identification, the etiological agent is a short, motile, gram-negative rod that is cytochrome oxidase negative. The isolate should ferment glucose with both acid and gas production, and the TSI (triple sugar iron) reaction should be alkaline slant and acid butt, with gas and H_2S production.

Figure 1. *Edwardiella tarda* septicemia in a channel catfish. Note the large area of hemorrhage surrounding an abscess near the pectoral fin. (Original photo by Fred Meyer.)

Figure 2. Area of muscle necrosis associated with *Edwardsiella tarda* infection in a catfish. (Photo by John Hawke.)

2. Confirmatory Diagnosis

a. A confirmed diagnosis is accomplished if the isolate agglutinates in the slide or microtiter agglutination test with *Edwardsiella tarda* antiserum. The enzyme immunoassay (EIA) and FAT were shown to be fast and efficient for the confirmatory diagnosis of *Edwardsiella tarda* (Rogers 1981).

The EIA method also has the advantage of being inexpensive and adaptable for most labs. Caution should be used in these tests because there are many serotypes. Confirmatory tests may fail with the use of a monovalent antiserum.

b. If a diagnostic antiserum is not immediately available, the isolate may be identified by use of the API 20E system (Analytab Products, Inc., Plainview, New York). *Edwardsiella tarda* should produce reactions leading to the code number 4544000, although there may be some variation depending on the biotype cultured.

F. Procedures for Detecting Subclinical Infection

Culture can be attempted from the internal organs, intestine, or surface tissues of fish. It is not known if species-specific primers are available for PCR analysis.

G. Procedures for Determining Prior Exposure to Etiological Agent

No procedures have been reported.

H. Procedures for Transportation and Storage of Samples to Ensure Maximum Viability and Survival of the Etiological Agent

See Section 1, 1.1.1 General Procedures for Bacteriology.

References

Amandi, A., S. F. Hiu, J. S. Rohovec, and J. L. Fryer. 1982. Isolation and characterization of *Edwardsiella tarda* from chinook salmon (*Oncorhynchus tshawytscha*). Applied and Environmental Microbiology 43:1380-1384.

Austin, B., and D. A. Austin. 1987. Enterobacteriaceae Representatives. Pages 196-224 *in* Bacterial Fish Pathogens: Disease in Farmed and Wild Fish. Ellis Horwood Ltd., Chichester England.

Bockemuhl, J., R. Pan-Urai, and F. Burkhardt. 1971. *Edwardsiella tarda* associated with human disease. Pathologia et Microbiologia 37:393-401.

Coles, B. M., R. K. Stroud, and S. Sheggeby. 1978. Isolation of *Edwardsiella tarda* from three Oregon sea mammals. Journal of Wildlife Diseases 14:339-341.

Egusa, S. 1976. Some bacterial diseases of freshwater fishes in Japan. Fish Pathology 10:103-114.

Ewing, W. H., A. C. McWhorter, M. R. Escobar, and A. H. Lubin. 1965. *Edwardsiella* a new genus of Enterobacteriaceae based on a new species, *E. tarda*. International Bulletin of Bacterial Nomenclature and Taxonomy 15:33-38.

Hawke, J. P. 2000. Bacterial Disease Agents. Pages 69-97 *in* R. R. Stickney, editor. The Encyclopedia of Aquaculture. John Wiley and Sons, New York, New York.

Herman, R. L., and G. L. Bullock. 1986. Pathology caused by the bacterium *Edwardsiella tarda* in striped bass (*Morone saxatilis*). Transactions of the Americian Fisheries Society 115:232-235.

Kuo, S-. C., H-. Y. Chung, and G-. H. Kou. 1977. *Edwardsiella anguillimortifera* isolated from Edwardsiellosis of cultured eel (*Anguilla japonica*). JCRR Fisheries Series No. 29, Fish Disease Research 1:1-6.

Liu, C. I., and S. S. Tsai 1982. Edwardsiellosis in pond cultured eel in Taiwan. CAPD Fisheries Series No 8, Report on Fish Disease Research 4:92-95.

Meyer, F. P., and G. L. Bullock. 1973. *Edwardsiella tarda*, a new pathogen of channel catfish (*Ictalurus punctatus*). Applied Bacteriology 25:155-156.

Miyazaki, T., and S. Egusa. 1976a. Histopathological studies of Edwardsiellosis of Japanese eel. I. Natural infection-suppurative interstitial nephritis. Fish Pathology 11:33-43.

Miyazaki, T., and S. Egusa. 1976b. Histopathological studies of Edwardsiellosis of Japanese eel. II. Suppurative hepatitis. Fish Pathology 11:67-75.

Plumb, J. A. 1999. Health Maintenance and Principal Microbial Diseases of Cultured Fishes. Iowa State University Press, Ames, Iowa. 328 pp.

Rogers, W. A. 1981. Serological detection of two species of *Edwardsiella* infecting catfish. Developments in Biological Standardization 49:169-172.

Sae-Oui, D., K. Muroga, and T. Nakai. 1984. A case of *Edwardsiella tarda* infection in the colored carp (*Cyprinus carpio*). Fish Pathology 19:197-199.

Wakabayashi, H., and S. Egusa. 1973. *Edwardsiella tarda* (*Paracolobactrum anguillimortiferum*) associated with pond-cultured eel disease. Bulletin of the Japanese Society of Scientific Fisheries 39:931-936.

Wyatt, L. E., R. Nickelson II, and C. Vanderzant. 1979. *Edwardsiella tarda* in freshwater catfish and their environment. Applied and Environmental Microbiology 38:710-714.