Ichthyophonus

I. Causative Agent and Disease

Ichthyophonus hoferi, the causative agent reported for the disease ichthyophoniasis, may comprise several different populations or strains. Although once considered a member of the fungi, *Ichthyophonus* was recently reclassified as a protozoan member of the class Mesomycetozoea, a highly diverse group of organisms having characteristics of both animals and fungi. The severity of disease is dependent on the general stress and health of the fish host. Disease can be acute with mortality, chronic with reduced performance or subclinical. *Ichthyophonus* is a systemic pathogen localizing in major organ systems including the heart. Infected fish are carriers for life.

II. Host Species

Ichthyophonus has infected a wide range of freshwater, marine and anadromous fish (80 species), amphibians and reptiles worldwide.

III. Clinical Signs

The gross clinical signs of *Ichthyophonus* can be confused with other similar conditions. A strong inflammatory response against the parasite often results in visible granulomas encapsulating the macrospores of the organism. These granulomas contain host lymphocytes, macrophages, neutrophils and fibrous connective tissue that appear as white, yellow or brown foci in infected tissues such as the spleen, liver, kidney, skeletal muscle and especially the heart.

IV. Transmission

Ichthyophonus is an obligate pathogen likely of marine origin. Piscivorous fishes are infected through consumption of infected prey while rainbow trout can be infected horizontally by cohabitation. Similar transmission studies with planktivorous species, such as Pacific herring, have failed by both routes.

V. Diagnosis

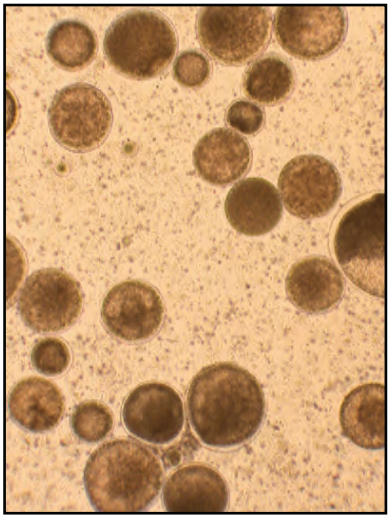
Microscopic diagnosis is made by wet mounts of infected tissues, usually lesions of the heart or muscle. Tissue explant cultures using a liquid *Ichthyophonus* medium can increase detection in lightly infected fish that are not clinically diseased. Microscopic or histological examination of infected tissues demonstrate the characteristic variously sized macrospores (schizonts) and hyphae (germination tubes) of the organism. PCR is useful to confirm cultures, diagnose severe infections of *Ichthyophonus* or when the organisms are no longer viable for culture.

VI. Prognosis for Host

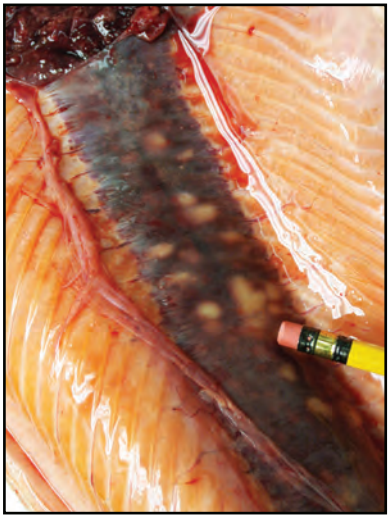
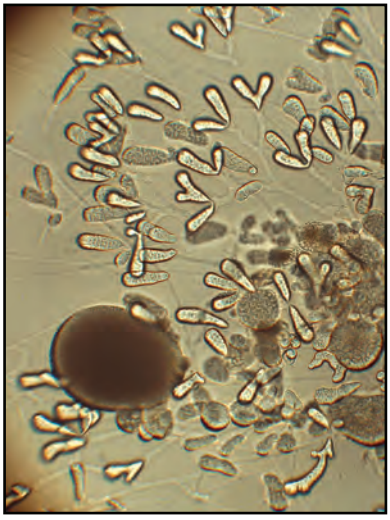
Some species, such as Atlantic herring, are more susceptible to *Ichthyophonus* infections and have sustained mass mortality from the disease. Other species and some stocks within a species have more resistance to exposure and may become infected with the parasite without serious consequences. In experimental studies with juvenile herring, death from injection of *Ichthyophonus* macrospores can occur in 80% of the fish within 60 days. Other field studies of adult Pacific herring have suggested the pathogen can persist for long periods without initiating rapid disease or mortality.

VII. Human Health Significance

This parasite is a pathogen only for poikilothermic animals. Therefore, there are no human health concerns associated with *Ichthyophonus.*

Left: Diffuse white coalescing granulomas containing *Ichthyophonus* in a salmon fillet; **Right:** Various sized schizonts in a wet smear of a granuloma, X 200.

Left: White granulomas of *Ichthyophonus* in the kidney of a coho salmon; **Right:** Culture of round various-sized schizonts (largest lower left) surrounded by elaborate branched germination tubes (hyphae), X 400.