ROSEOVARIUS OYSTER DISEASE

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Introduction

Roseovarius Oyster Disease (ROD), previously known as Juvenile Oyster Disease (JOD), affects hatchery-raised seed of eastern oysters, *Crassostrea virginica*, on the east coast of the U.S. from Maine to New York. The disease is caused by a marine α–proteobacterium *Roseovarius crassostreae*, a member of the *Roseobacter* clade. Members of the species produce pink or greenish-yellow colonies. Disease syndrome is comprised of retarded growth, mortality, unequal shell growth, cupping of the left valve, shell checks and conchiolin rings ("brown rings") on the internal surface of the shells.

In histological sections, hemocytes (blood cells) and debris lay underneath the conchiolin on the mantle epithelium. Conchiolin is often deposited between the adductor muscle and shell, causing gaping and death. Mantle epithelium degenerates, and bacteria and ciliates invade the tissues. ROD resembles a better studied "Brown Ring Disease" in Manila clams (*Ruditapes philippinarum*), caused by a bacterial infection by *Vibrio tapetis*.

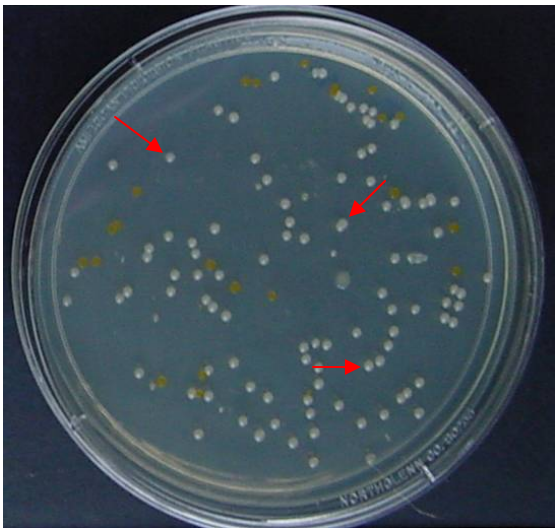
ROD has caused mortalities in hatchery-reared oysters in the northeastern U.S. since 1988. Long Island hatcheries were among the first to experience serious losses. The first Connecticut outbreak was observed in 2000. ROD continues to cause sporadic mortalities.

Infection and mortality

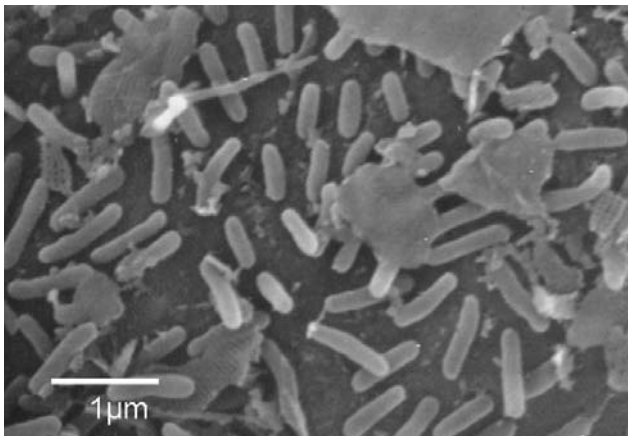
Sudden and often significant mortalities occur only in infected oysters under 25mm in length. Mortalities associated with ROD occur from late June until September. First evidence of infection (growth arrest) can be detected only one week before mortalities. Mortalities (20 – 100%) last from four to six weeks. ROD mortalities typically occur at temperatures between 21 and 26 ^{0}C and salinity ranges from 25 to 32‰. Low salinities can inhibit the disease.

Deformed shells of ROD-infected seed oysters. (Inke Sunila)

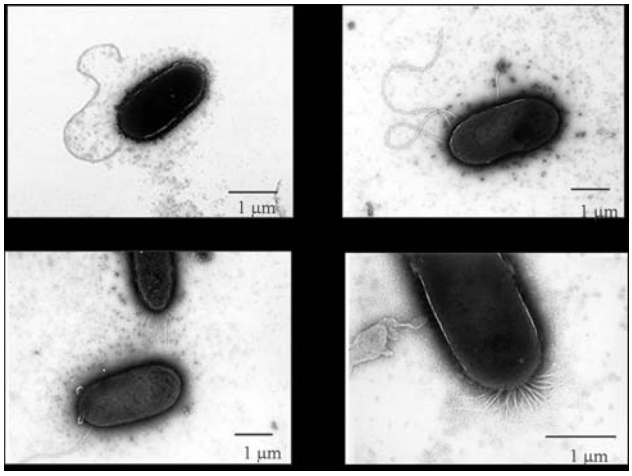
Conchiolin rings on shells of ROD-infected seed oysters. (Inke Sunila)



The pinkish-beige isolates on this plate are *Roseovarius crassostreae* cultured from an infected oyster. (Katherine Boettcher)



A scanning electron micrograph of *Roseovarius crassostreae* underlying a conchiolin deposit on the internal surface of an oyster shell . From Boardman et al. 2008. *J. Invert. Pathol*. 97:150-158. (With permission from Elsevier)



***Roseovarius crassostreae* cells, negative stain under transmission electron microscope. From Boettcher et al. 2005. *Int. J. Syst. Evol. Microbiol.* 55:1531-1537. (With permission from the Society for General Microbiology)**

Resistance

Survivors of a ROD outbreak can be used in selective breeding programs to produce potentially ROD-resistant strains. Oysters with additional shell growth after shell checks (specimens that acquired the infection but survived) can be spawned to produce new lines.

Connecticut status

ROD affects only hatchery-raised oyster seed. Connecticut's oyster production is mostly based on natural set, and consequently ROD doesn't have serious impact on oyster production. A ROD outbreak occurred in year 2000 in the MSX-resistant "Clinton" strain in several separate oyster nursery systems. A ROD-resistant oyster strain was derived from the surviving oysters. More recent outbreaks occurred in 2006 and 2007. Less than one percent of wild oysters in Connecticut display conchiolin rings similar to ROD-infected seed.

How do I know if my oyster seed is infected with ROD?

Roseovarius Oyster Disease refers to a set of symptoms in hatchery-raised seed oysters in northeastern US. There is no gold standard for accurate diagnosis. ROD can be diagnosed from oyster shells. Infected oysters have shell checks and characteristic conchiolin rings inside the shell. Mortalities are preceded by growth arrest. However, other factors, e.g. toxic algae blooms, can also cause growth arrest in a seed oyster culture in the region. ROD can be also diagnosed by culturing the bacteria on marine agar or by PCR (polymerase chain reaction). The Bureau of Aquaculture provides a diagnostic pathology service for Connecticut's commercial oyster growers.

GUIDELINES FOR ROD MANAGEMENT IN CONNECTICUT

- Decrease density of oyster seed in the nursery system.
- Increase flow rate in the oyster nursery system.
- Avoid infection window by deploying seed early so that it exceeds 25mm in the end of July.
- Use ROD-resistant oyster seed.

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